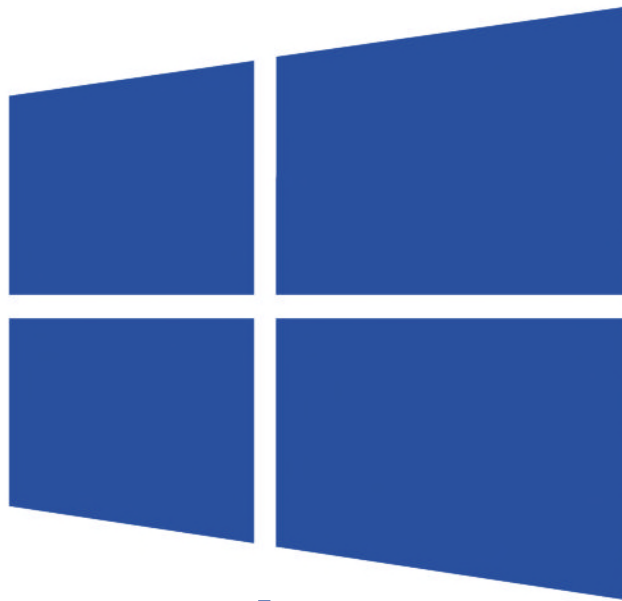




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- Google Now: make it work for you p32
- **Disaster-recovery cheat sheet** p108
- The first £299 3D printer p77

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Windows 10

The review.





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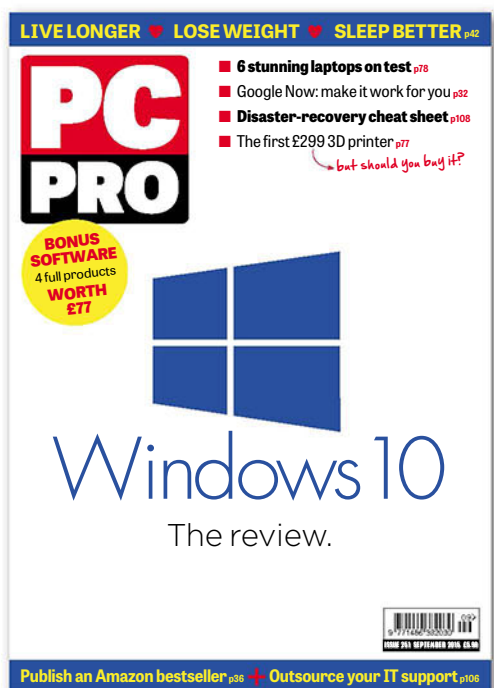
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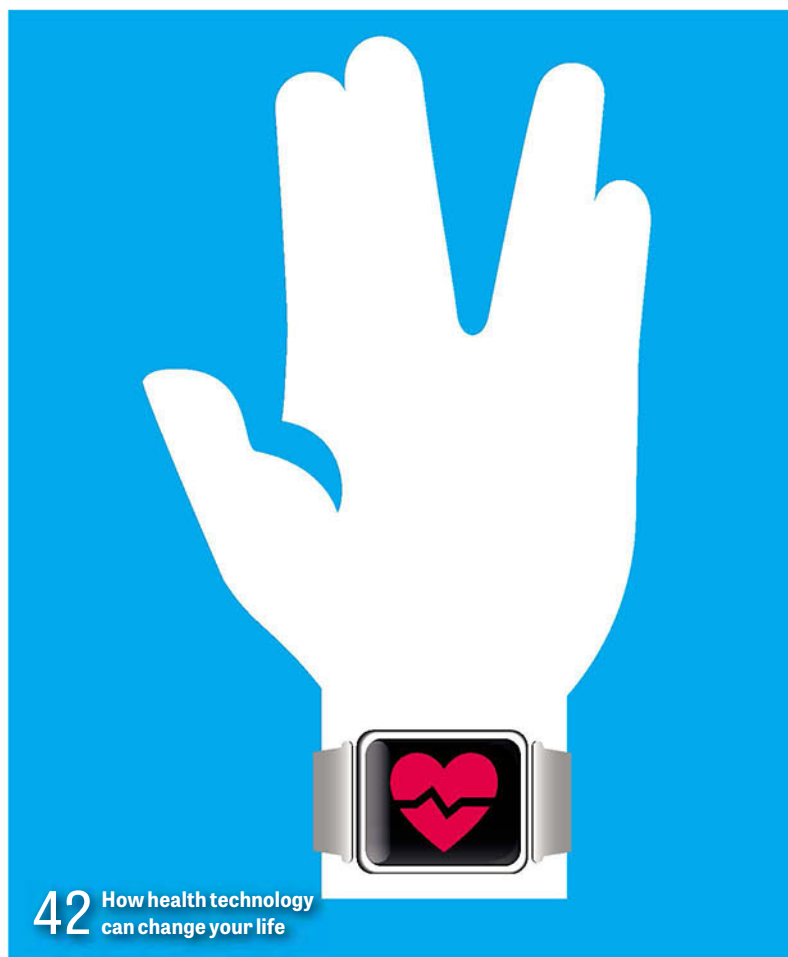
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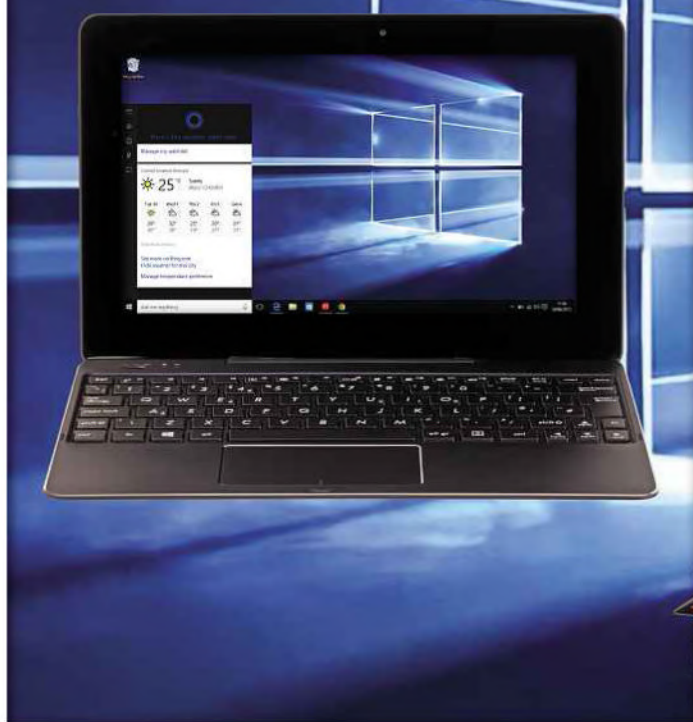
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Editor's letter

SHE LEANED OVER, whispered in my ear: "I have a confession to make." I took a slug of wine to steady the nerves. "Go on." She nudged her chair closer, making absolutely sure our table companions couldn't hear. "Last month, my boss bought me a tablet to use at work. Top of the range." She hesitated before revealing her guilt-laced confession. "I haven't opened the box."

This was three years ago, and while my fading memory can't recall my reaction to this revelation, the one thing I'm certain of is that my nameless dinner companion wasn't alone. Thousands of tablets must litter the desk drawers of businesses around the country, abandoned once their owners had completed the False Tablet Hope Curve: excitement about what this magical device could bring; experimentation as they tried to fit it into their daily workflow; disappointment when they hit the glass ceiling of its limitations; and boredom once they realised it was just another device to lug around to meetings.

Now I realise that many have succeeded in placing the tablet near the heart of their business lives. There are great apps out there, and productivity tools such as Office continue to improve. But for me, there will only be one king when it comes to getting stuff done: the laptop.

For proof, I need only look at my current state of giddy anticipation. At some point this week, our IT department is going to give me a new laptop. Not just any laptop, but the laptop I fell in love with at CES earlier this year: the Dell XPS 13. It's slim, super-light and drop-dead gorgeous. Most of all, it's a machine I can do real work on.

I struggle to put my absolute joy into words; forget "Twittersphere" and other new vocab that's found its way into dictionaries thanks to technology, as Nicole Kobie

discusses on p52. Because what we really need is a word to sum up *that* feeling. The partnership between man and machine, a tool tuned to my needs. Fast enough to handle the tougher tasks I occasionally throw at it. Equipped with the weapons I need to complete jobs quickly, whether that's a pleasant keyboard to type on or a large enough screen to view a big spreadsheet.

To be fair, my current Latitude laptop does all those things perfectly well. It still has more than enough grunt to handle my processing demands. In reality, the biggest change between my 2012 vintage Dell and the class of 2015 boils down to form rather than frequency: the new model is so much lighter and more compact. And for someone who lugs their laptop home with them every day, I can't understate the value of that change.

If I'm honest, there's another physical change I'll appreciate as well: the Dell XPS 13 is just a little bit sexy. It's a laptop I'll be happy to be seen with, whether on the morning commute or in a meeting with the hipster entrepreneur behind a trendy Californian startup.

For let's not fool ourselves, the laptops we use have become a shorthand for declaring who we are. More and more people will be asking for MacBook Pros – the winner of our Laptops of Desire group test on p78 – to replace their battered Dells. The only question is: when junior execs are using the MacBook Pro, what do you offer the CEO? The answer is obvious: an 18-carat Yellow Gold MacBook Pro is surely only weeks away.

Tim Danton
Editor-in-chief

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Darien Graham-Smith As our cover oh-so-subtly hints, Windows 10 has landed. Our in-depth review on **p60** explains why this is one upgrade worth grabbing.



Stewart Mitchell Can tech help you lose weight, sleep better and live longer? Stewart and our team of lab rats explore how health tech can change your life. **See p42**



Olivia Whitcroft Don't just sign on the dotted line, implores Olivia, a lawyer who specialises in tech. Check through the Ts&Cs of your service contract or be left stranded. **See p116**



Nik Rawlinson It's never been easier to make money through self-publishing. On **p36** ebook author Nik reveals some cunning ploys to make your words pay.

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outburst that won't
offend the in-laws."

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write with a pen."

"I'm trouserless during
business conversations
far more than I was 20
years ago."

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Grey-market goods could land you with a tax bill **p16**

Apple changes its tune on privacy

Amid a raft of new product launches at the Worldwide Developers Conference, Apple also wants to sell us something different: our privacy. **Nicole Kobie** explores what it's worth



A NEW VERSION of iOS (see p75), a revamp of OS X (see p74) and the long-awaited launch of Apple Music may have been what everyone was waiting for at the Worldwide Developers Conference (WWDC), but Apple had one more thing to sell to us this year: our privacy.

Personal privacy has become Apple's unique selling point, with new features announced alongside promises to leave data in users' hands. The shift follows CEO Tim Cook's headline-grabbing speech from a few weeks earlier, in which he accused rivals such as Google of cashing in on its customers' data (see [pcpro.link/251tcspeech](#)).

With no search-engine business to prop up (unlike Google and Microsoft) and \$200 billion in the bank, Apple can comfortably afford to shun the opportunity to sell customers' data. But does Apple's privacy pledge make its products any more attractive to end users?

■ Serious Siri privacy

At WWDC, Apple announced iOS 9, saying that smart assistant Siri and advanced search tool Spotlight will gain "proactive" intelligent capabilities, knowing what users want before they ask for it. They achieve this feat by sharing data between apps and looking for patterns. Siri, for example, will pull event data from emails into the calendar. If that sounds familiar, it's because such a feature already exists on rival platforms, and Google plans to beef up the predictive capabilities of its Google Now assistant in the next version of Android.

Apple may be playing catch-up with such features, but it's taking the lead with privacy, stressing that all personal data will be held on your phone, not its servers. Senior vice president of software engineering, Craig Federighi, stressed that none of the data gathered for Apple's smarter search would be associated with an

Apple ID, nor linked with other Apple services or shared with third parties.

"Apple is competing head-on with Google, with iOS 9's proactive intelligence and improved search throughout the iPhone and iPad UI," noted IHS Technology analyst Ian Fogg. "Apple hopes to differentiate by protecting users' privacy, but it must ensure that such protection doesn't cause the intelligent services it delivers to be anything but the best."

The protection of personal data was a consistent message with other new features, too. For example, News is an app with content pulled directly from and curated by top publishers, such as *The New York Times* and *The Guardian*. Federighi stressed that none of your individual data will be shared with third parties and what you read won't be linked to other Apple services.

Preventing the free flow of personal data isn't the only privacy measure in iOS 9. Apple's mobile OS will also allow developers to make ad-blocking tools – handy for those who dislike behavioural advertising systems – and will offer an API for virtual private networks.

■ Privacy sales pitch?

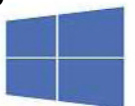
Apple's striding purposefully towards the moral high ground, but is privacy a consideration for most consumers when it comes to buying a smartphone

ABOVE Apple CEO Tim Cook is making personal privacy the company's unique selling point

Five stories not to miss

1 Microsoft releases Windows 10

Microsoft has released Windows 10, with free upgrades for those running Windows 7 or 8.1. Otherwise, it will cost £99 for the Home edition – a premium compared to the US price of \$119, even with VAT considered. Head to p60 for our full review.



Swift beats Apple Music

Apple has finally entered the music-streaming market with Apple Music – although it was forced to make changes to the service before it even launched, thanks to pop star Taylor Swift.

Apple Music is different to rivals such as Spotify and Google Play Music. While you can stream your choice of song from the 30 million track catalogue, there's also a curated radio station called Beats 1 with DJs picking the tunes. "Apple Music has a vision that's at odds with iOS 9's proactive intelligent assistant," said IHS Technology analyst Ian Fogg. "While iOS 9 aims to deliver intelligent experiences automatically, Apple Music seeks to differentiate with human curation."

The service costs \$9.99 per month or \$14.99 for up to six family members sharing an account, but you don't need



an iPhone to listen; it will also be available on rival platforms. "Strikingly, Apple announced that the service will be available on Android devices in the autumn," said Fogg. "This will be the first branded service to reach Android and is a strategic shift for Apple in its approach to the main rival platform."

Apple is offering a three-month free trial, and had initially told record labels it wouldn't pay them for music streamed during that period. After a few hours of pressure from chart-topping Taylor Swift – who threatened to withdraw her latest album from Music – Apple caved in and declared it would indeed pay royalties during this period.

The firm that once dictated terms to the entire music industry was cowed by a 25-year-old singer. How times have changed.

or tablet? "I don't think privacy is likely to be a major factor in people choosing a handset for a long time, if ever, but it could be a contributory factor, and could certainly be part of a choice of brand or ecosystem," said Dr Paul Bernal, a lecturer in tech law and privacy at the University of East Anglia. "I suspect Tim Cook's doing a mixture of things here: differentiating Apple from Google is a clear part of it, but it may be more direct in the sense that privacy could become part of the 'coolness' that Apple likes to surround itself with," he added.

Digital privacy is in the spotlight in this post-Snowden era, but it remains to be seen whether Apple can make privacy "cool" enough to counter cutting-edge but invasive features such as Google Photos, which organises photos across devices and understands them well enough to let users search for all the images of them having breakfast, for example.

Benedict Evans, an analyst at venture-capital firm Andreessen Horowitz, suggested in a tweet after Cook's speech that Apple's aversion to data mining may leave it behind – just as BlackBerry was once left in the dust by the iPhone. In 2007, the company then known as RIM stated that nobody would want an iPhone as there would be battery-life trade-offs; now, Apple is saying "no-one wants image search – there are privacy trade-offs," Evans remarked.

In the battle between privacy and features, can Apple win on the former? Bernal said he'd trade in his handset for a more privacy-friendly one, although he admitted: "I don't think I'm a typical consumer." ●

BELOW iOS 9 will feature proactive intelligent capabilities



The Secret Diary of Tim Cook

We had this incredible vision for Apple Music. We wanted to say hey, come and try this service for three months, and enjoy all the music you love, and you won't have to pay a cent. And neither will we.

It's the kind of innovation that runs in our blood. When we look at the world, we ask ourselves how it could be made better. Last year, more than 500 million iTunes users were able to enjoy U2's amazing album on day one. That was truly an exciting moment in history, and to make it happen we ended up paying the band \$100 million. So then we thought, how incredible would it be if we could make that magic happen for free?

But sometimes people are invested in their old ways of doing things. And we say, that's great. At Apple, our mission is to help people do the things they love.

Well, it turns out that one of the things Taylor Swift really loves is getting paid. So we said okay: let's dial back a little and give our friends the space they need to catch up. We've made some changes to our licensing deal, and I know Taylor's going to love being on Apple Music.

But we're not stopping there. Apple has always been about challenging old ideas, and our accountants are going to keep on innovating, and find new ways to change the world. It's in our DNA.

2 Adobe CC update

Subscribers to Adobe's Creative Cloud suite have received a host of new features, including a haze removal tool in Lightroom, UI and app design tweaks for Photoshop, and performance boosts for InDesign (see p70). Plus, Adobe is finally bringing CC to Android, and added a photo library following its purchase of Fotolia last year.



3 Lenovo's £130 PC on a dongle

Lenovo has unveiled its first system based on Intel's Compute Stick spec, which crams a full computer into a dongle-sized device. The Ideacentre Stick 300 features runs Windows on a 1.33GHz Atom processor, with 2GB of RAM and 32GB of storage for £130. It connects via HDMI to a TV or monitor.



4 Amazon to pay authors by the page

Put a Kindle ebook down without finishing it, and Amazon may not fully pay the author. That's under a new system Amazon is trialling. Amazon pays authors when their books are digitally loaned out, but will now scale that rate based on how many pages readers actually get through.



5 Project Lightning hits Manchester

Work has begun on Virgin Media's £3bn project to extend fibre broadband to four million more homes and businesses in the UK by 2020. Manchester is first to benefit from Project Lightning, with would-be customers being asked to log their interest at virginmedia.com/cablemystreet.



British homes are mobile notspots

You may need to step outside to make that call, research into blackspots reveals

Sending a text message? Get out of the kitchen – especially if you’re in Liverpool – because that’s one of the worst spots for connectivity in Britain, according to new research.

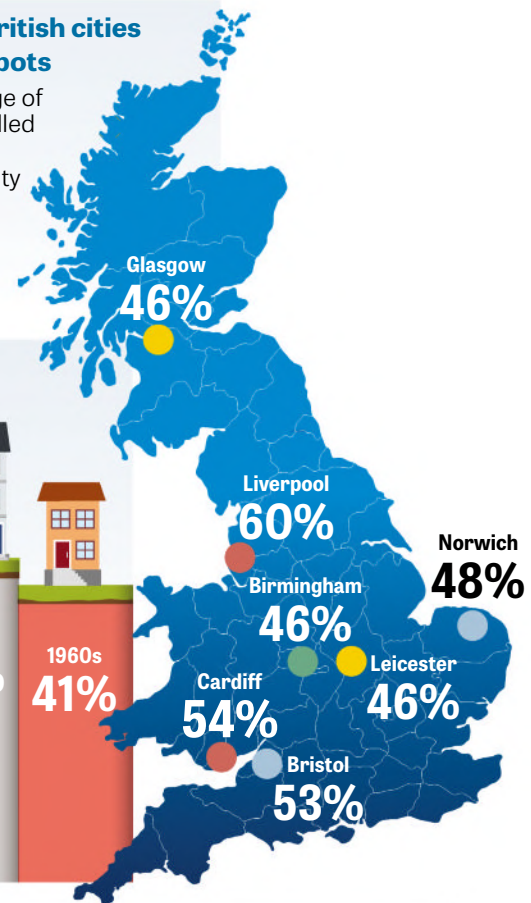
Under Ofcom rules linked to spectrum sales, mobile operators need to provide a certain level of coverage. For 3G, operators had to cover 90% of the UK. For 4G, O2 must cover 98% of the UK population by the end of 2017 – and that’s indoor coverage.

However, according to research from Global Wireless Solutions (GWS), 40% of Brits face mobile notspots inside their homes, with Georgian architecture seemingly acting as a Faraday cage.

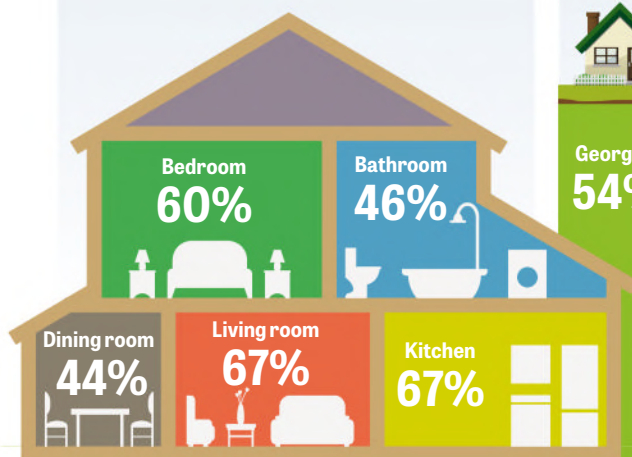
While operators have reached good coverage levels for 4G outside of homes, the service degrades as soon as we step inside. “The UK is no longer a ‘fixed-line’ nation,” said Paul Carter, CEO of GWS. “The best phone is the one you’ve got on you – not the one sitting in its dock out in the hallway.”

Worst British cities for notspots

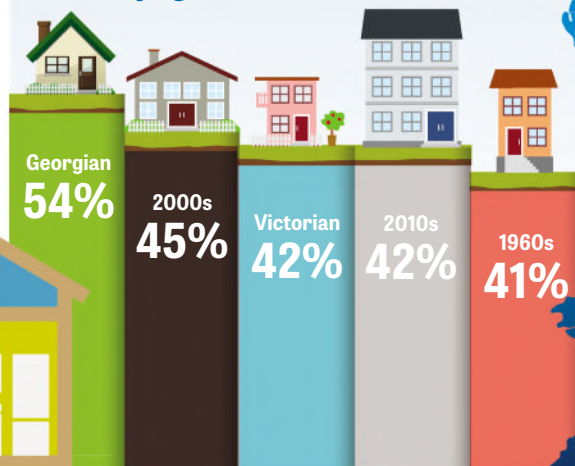
percentage of people polled reporting connectivity issues



Reported notspots in British homes by room



Reported notspots in British homes by age of home



GCHQ accused of hacking antivirus software

HACKERS SEARCHING FOR vulnerabilities in antivirus software is no surprise, but for the past eight years our security services have been doing the same.

That’s according to documents leaked by Edward Snowden, the whistleblower hiding in Russia following revelations two years ago of mass surveillance and snooping undertaken by the US government. Documents disclosed by *The Intercept* showed the NSA and our own GCHQ were reverse-engineering antivirus software in order to discover flaws they could use to monitor online traffic, ensuring their own spying techniques weren’t spotted.

The spying agencies specifically targeted security firms that weren’t



based in their home countries, notably Russia’s Kaspersky, Finland’s F-Secure and Romania’s Bitdefender. US firms McAfee and Symantec and Britain’s Sophos weren’t targeted. Kaspersky appeared to be a key target; the NSA saw emails sent to the firm, user data, and malware that was being targeted.

The Russian antivirus firm denied user data was leaked, but said it was “extremely worrying” – if not surprising – that security services would work to “subvert security software that’s designed to keep us all safe”.

What we think: “It’s certainly not surprising to see the NSA and GCHQ targeting antivirus

software – or taking action that could reduce online security for the rest of us,” said Briefing and Futures editor Nicole Kobie. “Poking holes in antivirus and not alerting the companies making it would be considered irresponsible for any security researcher, but intelligence agents clearly work under different rules to the rest of us – and of course we must assume security services for other nations are doing the same.”

What you said: On Alphr, Martin Fox wondered why people continue to be surprised by the spying activities of the NSA and GCHQ. “I would be more confused [or] concerned if a spy agency weren’t engaging in such activities,” he said.

Indeed, isn’t that the job of MI5 and MI6, agreed commenter severn sea? “I think it would be very naive to believe we live in a society where this sort of thing wasn’t going on,” he wrote.

Others disagreed. “Deep concern is natural when we see the extent to which boundaries of democratic accountability and due legal process have been secretly and insidiously pushed back,” noted AndyDay.

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Amazon brought to ebook as European Commission bares its teeth

The EU's competition chief has announced another pair of investigations into American tech firms. **Nicole Kobie** reveals why Amazon and Apple are under scrutiny

AMAZON AND APPLE are the latest American tech firms to feel the wrath of the European Commission (EC) over alleged anti-competitive behaviour.

In June, the EC opened an antitrust inspection into Amazon's ebook deals with publishers, and it's also investigating how Apple signed up labels to its music streaming service (see *Apple to face the music*, below). In May, Google was charged with abusing its dominant search market position and faces a potential €6 billion fine – after thrice failing to reach a settlement – and the EC said it was also investigating e-commerce across the common market.

The EC's sudden burst of energy appears to be down to the new head of competition policy, Margrethe Vestager. Since Vestager took power in November, she's shown a willingness to lock horns with the biggest names in technology, leaving many wondering: who's next?

■ The case against Amazon

While Vestager's investigation against Amazon has only just started, concerns over the ebook market go back years. While the EU opted not to fine Apple in 2012, alongside the five largest book publishers, for colluding to drive up prices – a direct response to Amazon's success in driving prices down – the US Department of Justice pushed for a financial settlement worth hundreds of millions of dollars. Following that, Amazon was last year embroiled in a dispute with publisher Hachette over the setting of ebook prices, pulling some of the publisher's



titles from its online store. The pair have since reached an agreement.

Now, the EC is looking into claims that Amazon forces publishers to offer it the best terms, ensuring Amazon's rivals never get a better deal under what's known as "most favoured" status. Vestager said: "It is my duty to make sure that Amazon's arrangements with publishers are not harmful to consumers, by preventing other ebook distributors from innovating and competing effectively with Amazon. Our investigation will show if such concerns are justified."

The investigation will focus on German- and English-language

ABOVE Margrethe Vestager believes that US giants may be engaging in anti-competitive behaviour



markets, the largest for ebooks in Europe. There's no timeline for when the investigation will come to an end. "Amazon is confident that our agreements with publishers are legal and in the best interests of readers," a company spokesperson said when the investigation was announced.

Richard Mollet, CEO of the Publishers Association, welcomed the investigation, saying his trade body has been calling for action for the past few months. "It's been felt for some time that it isn't clear in the UK whether the market conditions are fair," he told *PC Pro*.

Pointing to Amazon's dispute with Hachette, he said that "clearly, there were practices going on in those markets that didn't appear to be fair", and it was time to "smoke out" the situation. Amazon's decision to drop key Hachette titles following the dispute between the two "showed that the potential for harmful consequences are there," Mollet added.

So why did it take so long for there to be an investigation? "The ebook market is still pretty nascent across Europe," Mollet said, noting that the UK fiction market is 37% ebooks, and that's the largest proportion in Europe.

Apple to face the music?

Apple's streaming service, Music, was only announced in June (see p10), but as far back as April the European Commission was reportedly sniffing around its relationships with music labels, sending questionnaires to partners and rivals.

At issue are Apple's reported attempts to convince top-selling musicians to offer their music exclusively via its own service and lock out its competitors, but Apple has other means of enticing artists from its rivals. Music will be preloaded on

iPhones, making it easier to sign up users to the free trial. If it converts them to paying users, Apple gets to keep the whole fee, while it charges other app makers 30% for subscriptions generated via its devices. This makes it easier for Apple to offer more generous terms than Spotify, for instance.

The EC hasn't formally announced an investigation, but the New York Attorney General's Office has, suggesting pressure may build on both sides of the Atlantic.

Plus, some companies may be “reticent” to come forward with evidence. “It’s obviously a potentially difficult step for a company to raise a flag against what it might perceive as unfair practices, so these things take time to come out,” he added.

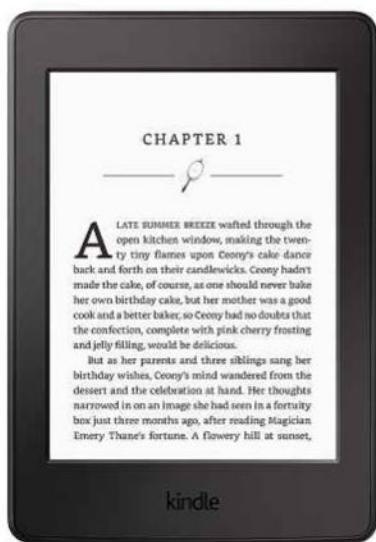
Amazon is also being investigated by the EU over whether its tax structure violated competition laws, and has already said it will alter how it pays taxes across the EU, following the introduction in the UK of the so-called “Google Tax” that bills companies 25% on any profits being routed offshore.

That suggests that American giants can indeed be brought to heel by European lawmakers. Taming Amazon’s competitive streak may prove more difficult, but Vestager seems more than up for the fight.

■ Anti-Americanism?

Vestager’s activity hasn’t won her fans across the Atlantic. Earlier this year, US president Barack Obama warned against European protectionism, although Vestager has stressed she’s not picking a fight with Silicon Valley. “We’re not actually targeting US companies – we don’t have a geographic bias,” she told Bloomberg. “This just reflects that there are many strong companies in the US that influence the digital market elsewhere.”

Indeed, Vestager has taken efforts to praise such companies, saying she uses Google’s “very good products” herself, while calling Amazon a “successful business that offers consumers a comprehensive service”. That said, Vestager’s also made it clear in interviews that she doesn’t take on companies unless she believes she’ll win. ●



The confusing shift to honest broadband

Ofcom is making it easier to switch to a new ISP if your broadband doesn't live up to what was promised – but moving may not yield faster speeds

OFCOM IS MAKING it easier to leave your ISP if your broadband speeds don’t live up to its promises – but the move may not actually benefit consumers.

Broadband ads lean heavily on speed figures, but research by *Which?* revealed that only 17% of Britons get the average speed advertised by their ISP – and even fewer during peak times. As usual, rural customers suffer the most, with only 2% achieving the advertised speed.

This is despite Ofcom signing up ISPs to a code of practice five years ago that was designed to provide more clarity about speeds via more accurate advertising, and to let customers switch to a new provider in the first three months of a contract if speeds didn’t live up to expectations. It’s not known how many people have exercised this option, since Ofcom doesn’t collect such data.

Ofcom’s new chief Sharon White addressed the issue in her first public speech, unveiling a new code of practice with one major change: you can now leave at any time in your contract if your speed falls below the “minimum guaranteed access line speed”. However, this figure isn’t fixed for every customer: it’s the bottom 10% of speeds that “similar customers” would receive – a figure that ISPs don’t have to reveal unless you ask specifically.

■ Time to move?

Ofcom is trying to make it easier for consumers to leave their ISP in other ways. A new switching process makes it simpler to move providers, and an investigation has been launched into ISPs that use “deliberate obstruction” to try to “hold on to customers who want to leave at the end of their contract,” said White.

Andrew Ferguson, an analyst at Thinkbroadband, questioned whether moving ISP was the best solution for customers. “There’s a danger that the new rules about being able to walk at any point may see people doing the merry-go-round of moving providers, chasing an elusive better speed, when

the reality is they’re 6km from the phone exchange,” he said. “[With] no cable broadband available, they’re never going to get better than 1Mbit/sec until a fibre-based solution arrives in the area.”

“If the same technology is used by different providers [then] connection speeds will be largely the same,” Ferguson predicted, although he noted that quality of service, especially at peak demand times, can vary between ISPs.

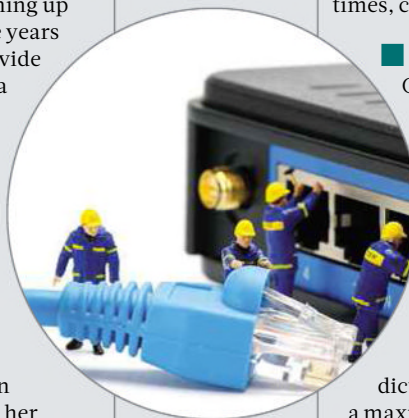
■ Forget advertising

Confusion over what speed you’re likely to receive is one issue, but Ferguson said that slow broadband is the root of the problem. More honest, easier-to-understand marketing would be welcome, but “it will not improve speeds for people”, he noted.

Advertising rules dictate that ISPs can advertise a maximum speed only if at least 10% of customers can actually receive it. According to *Which?*’s research, ISPs aren’t reaching that target, with only 4% of customers on TalkTalk’s 17Mbits/sec service achieving that speed – and only 1% of BT’s 76Mbits/sec package seeing such dizzying download rates. Both ISPs disputed *Which?*’s figures, saying that their own data shows that they’re meeting the 10% threshold and in many cases exceeding it.

Ofcom has attempted to ensure that customers signing up to new contracts have a realistic idea of what to expect by requiring ISPs to quote a range of speeds, showing what 20% of customers are likely to get and what 80% are expected to get, based on distance from the exchange. In other words, customers must be given a range of speeds that people in similar circumstances would get – a more complicated message, but a more realistic one than previous averages.

“We must remember that an advert is not a promise,” said Ferguson. “The key thing for the consumer is to learn their personal estimate at the time of signing up.”



ABOVE
Disappointment about slow broadband may not be solved simply by making it easier for customers to move



PCProbe

Grey imports – are they worth the risk?

It's often cheaper to buy tech products from overseas, but that discount might be down to tax avoidance. **Adam Banks** investigates

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Expedite Elec...	£584.96	
Jessops	£899.00	
Panamoz.com	£668.00	
Wex Photogr...	£999.00	

Olympus E-M5 MK II - £899 - wexphotographic.com

Ad www.wexphotographic.com/Olympus-E-M5

Buy Olympus OM-D E-M5 Mark II @Wex. 0% Down, 0% APR Over 12 Months.

These days, the best price for a gadget is only a click away. Google even helpfully lists promoted suppliers at the top of your results. But when some retailers offer prices that are 30% to 40% lower than others, is the deal too good to be true? Not necessarily. Welcome to the complicated area of grey imports.

Grey importing is when products are sold outside of normal sales channels: the sale itself is legal, but the goods are often shipped from outside the final market, raising issues of tax, duties, warranties and returns.

How can you spot a grey importer? Just because a site shows a UK phone number, that doesn't mean the firm is based here; many such sites operate from Hong Kong. That means your usual consumer rights won't apply, so check customer reviews before buying.

The busiest source of ratings is Trustpilot, a sort of equivalent to TripAdvisor for retailers. Most reviews you'll find on this site are glowing. A few sites, not mentioned on Trustpilot nor found in Google-sponsored results, are scams; you'll spot them by searching their name plus "review" or "problem". But those genuinely targeting UK consumers tend to attract loyal custom.

ABOVE Grey-market goods can be much cheaper than buying from the UK

RIGHT Trustpilot reviews can help you find a reliable overseas retailer

Common complaints

Unfortunately, not all resellers provide a good service. Many buyers of camera kit report receiving lenses or bodies that have been split from kits then repackaged, reducing their secondhand value. There are reports of inaccurate photos and orders. Interpretations of "in stock" can be elastic: while a wait of five or six days is usual, there are tales of items not showing up for a month. SLRHut customers noted that the firm phoned them before processing their online order; while some appreciated the personal touch, others objected to being offered alternative products.

Don't expect to receive "UK stock": goods may come from China, Russia or anywhere outside Europe. Whether this matters depends on the manufacturer. For example: Olympus, according to several users, will honour an international warranty based on any valid receipt, while lens-maker Sigma vocally opposes grey imports. Reportedly, Apple doesn't care where a product was bought, but watch out for technical differences, such as

PAL versus NTSC or different power-supply requirements.

Since you're not buying within the EU, you don't get a two-year guarantee as standard either. Grey importers normally offer their own, usually bought in from an international provider. If you need to use it, it will mean sending your product to a third-party workshop.

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Panamoz reviews

Excellent 9.8 from 0 - 10

252 reviews on Trustpilot | Latest review 3 hours ago

Rating distribution

Great prices and excellent service.

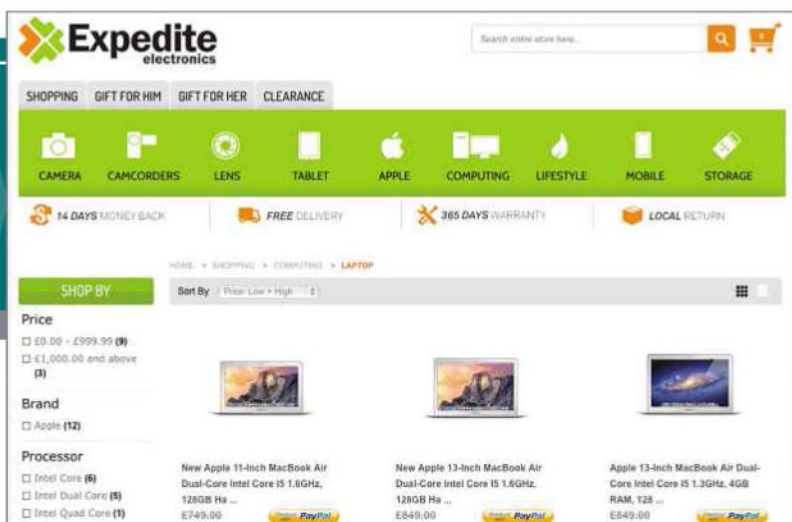
I have made two fairly large value purchases from Panamoz, both made using the BACS system. The latest order was placed first thing Friday morning and delivered the following Monday - effectively 'next day'. All communication was prompt and clear. I wouldn't hesitate to use them again. Plus many UK websites to share.

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We live here: United Kingdom

Category



Buying goods on the international wholesale market and offering them direct to UK customers isn't illegal (although it may involve a breach of contract somewhere). But in today's global market, it's not obvious why it's cheaper. Retailers such as Cam2 and Tin Cheung advertise the same prices online as in their Hong Kong shops, and it's rare you'll find them for less than the pre-VAT price in the UK. Yet much lower prices are advertised for UK imports.

Paying VAT

Presumably suppliers know where to go for the best wholesale deals. Could there also be an element of tax evasion? When goods are shipped from outside the EU to a personal customer, a tax bill is sent – usually via the courier firm – either to the supplier (if they've agreed to pay it) or to the customer. A known method of VAT evasion is to mark packages with a false value of less than the £15 threshold, rather than the real price paid.

We make no suggestion that any company named here is involved in this practice, but there are plenty of customer stories doing the rounds; one affirmed that his supplier had failed to “do an accurate customs declaration, to dodge the VAT. My camera was declared as low-value toy accessory.” The gamble doesn't always pay off: “I've since ordered a camera from another Hong Kong firm, which was delivered after being held by customs for seven weeks. I've paid the VAT and hope to be refunded [by the supplier].”

The Home Office's Border Force, not HMRC, now has responsibility for customs enforcement. A spokesperson told us that the agency aims to “disrupt any fraud which cheats UK taxpayers and undercuts honest businesses”, and that it carries out checks to “assess whether the values on customs declarations are credible”. Border Force will also “respond to any specific intelligence about the suspected undervaluation of goods”.

Some grey suppliers promise a refund if you receive a tax bill. That's highly suggestive of attempted misdeclaration, although it could happen due to error. Others just say you won't have to pay any tax, without explaining why. Simply Electronics is unusual in disclaiming responsibility for tax and duty, correctly warning that the customer may have to pay it.

We phoned several grey-importing companies for details. Twice we reached automated messages. A third supplier, based in England but under a name listed by Companies House as “dormant”, answered; following four attempts to track down an elusive manager, we had to give up. Finally, at Expedite Electronics, a woman with a professional telephone manner answered our questions briskly. Did the prices include VAT? No, because “the main company” was based in Hong Kong. Did that mean we might get a VAT bill? No: “You don't have to pay any VAT and the import duty and tax is already included.”

ABOVE Expedite Electronics told us that we wouldn't have to pay VAT on top of its advertised prices

If companies bring goods from outside the EU into UK warehouses and sell them on, they're responsible for the VAT, not the customer. If the goods are shipped directly to you from abroad, however, you're probably liable to pay the VAT on receipt. One problem is that there's no way for a consumer to easily check the tax has been paid. And if you're a VAT-registered business, you can't claim back the tax if it was paid by the importer. That adds 20% to the price you're paying, although you could still be saving overall.

Grey advice

If you're considering buying grey, go in with your eyes open. First, do the research. We found many items for hundreds of pounds less than regular UK prices, but a few items were actually cheaper in the UK. Read the terms and conditions, which will often be found on an “FAQ” or “Shipping” page. They vary from explicit – for example, requiring you to return faulty goods within a limited period – to insidious: when “shipping insurance” is an option, guess what that says about your position if goods arrive damaged?

Do pay by credit card (as a consumer), because the card issuer is jointly liable for purchases of more than £100, regardless of where it's from. Some debit cards offer voluntary protection too. You can request a chargeback against any card if goods aren't delivered, but you'll be relying on the co-operation of the merchant's bank, so don't hold your breath for a quick resolution.

If things do go wrong with a purchase, badger the retailer until it's put right. Insist on a replacement or refund, not a repair; if goods arrive faulty, cite breach of contract – a concept understood by courts everywhere. If necessary, log in to Trustpilot and post a complaint: many of these companies monitor reviews and may reply, and at worst you've helped to warn others of the pitfalls. ●

Other ways to buy abroad

Grey imports are distinct from personal imports. Foreign retailers may simply offer delivery to the UK, leaving it to you to pay the VAT and duty. For example, New York firm B&H (bhphotovideo.com) usefully shows a calculation of shipping, tax and duty while you're browsing an item. Foreign eBay sales work similarly, but misdeclaration isn't unknown here.

A few UK-based firms also sell grey imports, one example being HDEW Cameras (hdewcmeras.co.uk).

With prices as low as anywhere, and the reassurance of English law, it could be the best of both worlds. But some customers say the firm could be clearer about what you're getting, including kit splits.

One way to legally avoid some of the tax is to bring products with you when travelling into the UK from outside the EU. If the goods are worth more than £390 in total, you must go through the red channel, but you only have to pay VAT and duty on the value above that level.



The A-List

The ultimate guide to the very best products on the market today

LAPTOPS

Apple MacBook Pro 13in with Retina display

2015 model, from £999

apple.com/uk

With its innovative Force Touch trackpad, new Broadwell processors and the same excellent Retina screen, the MacBook Pro is better than ever. It's fast, with superior battery life to the previous generation, and that trackpad adds to all-round usability.

REVIEW: p84



SMARTPHONES

Samsung Galaxy S6

Android, 32GB, free phone, £35/mth, 24mths

omio.com

With the Galaxy S6, Samsung has finally created a phone as beautiful as it is capable. Superb performance, a nigh on perfect display and an astonishingly good camera provide the perfect foil to the most attractive Samsung handset yet.

REVIEW: pcpro.link/algals6



ALTERNATIVES

Lenovo IdeaPad Yoga 2

A versatile hybrid laptop with the best IPS screen in its class – now available at an irresistible price. **£380;** argos.co.uk **REVIEW:** pcpro.link/alyoga2

Asus Zenbook UX303LA

The latest Broadwell Core i7 and a quality screen make this Ultrabook both desirable and great value. **£699;** laptopsdirect.co.uk **REVIEW:** pcpro.link/alzb303

HP Stream 11

Good-looking, well built and equipped with a decent display, the petite Stream 11 is as good as it gets for the money. **£179;** hp.co.uk **REVIEW:** pcpro.link/alhp11

ALTERNATIVES

Motorola Moto G (2nd Gen)

A bargain: 5in screen, good battery life and 4G too. **From free, £20/mth, 24mths;** omio.com **REVIEW:** pcpro.link/almotog2

Sony Xperia Z3 Compact

Speedy performance, decent battery life and a fine camera – all for a great price. **From free, £25/mth, 24mths;** omio.com **REVIEW:** pcpro.link/alsonyz3

Apple iPhone 6

Apple steps up to a larger screen size with the classy, long-lasting 4.7in iPhone – but it's pricey. **64GB, from free, £35/mth, 24mths;** omio.com **REVIEW:** pcpro.link/alip6

TABLETS

Apple iPad Air 2

9.7in tablet, 64GB, £479

apple.com/uk

Even faster, even lighter and just as pretty as ever – the iPad Air 2 takes everything that made the original great and improves upon it. Updated cameras and the arrival of Touch ID are welcome upgrades, too. Its only real rival is the original 32GB iPad Air, now discounted to a tempting £359.

REVIEW: pcpro.link/alipair



PCs

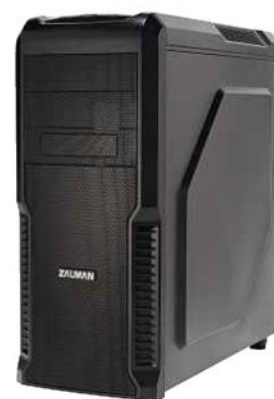
Chillblast Fusion Quasar

Base unit, £600

chillblast.com

Chillblast's Fusion Quasar is the very definition of a classy all-round base unit. A Core i5 CPU overclocked to 4.3GHz delivers plenty of raw power, combined with good gaming capability and serious upgrade potential. A five-year warranty seals the deal.

REVIEW: pcpro.link/alchill



ALTERNATIVES

Tesco Hudl 2

Tesco's budget Android tablet sports a high-quality 8.4in IPS display and great design. You can't top it for value. **£99;** tesco.com **REVIEW:** pcpro.link/alhudl2

Linx 8

Part of a new wave of ultra-affordable compact Windows tablets, the Linx 8 squeezes in plenty for the price. **£80;** pcworld.co.uk **REVIEW:** pcpro.link/allinx8

Sony Xperia Z2 Tablet

The most desirable full-sized Android tablet yet, thanks to great design and battery life. **16GB, £330;** johnlewis.co.uk **REVIEW:** pcpro.link/alxz2tab

Apple iMac 21.5in

A classy all-in-one with a compact frame, ample power and a colour-accurate screen. **From £899;** apple.com/uk **REVIEW:** pcpro.link/alimac215

Apple iMac 27in with Retina 5K display

Astonishing image quality and stunning resolution: a great PC. **From £1,599;** apple.com/uk **REVIEW:** pcpro.link/alimac275k

Acer Revo One RL85

An elegant but versatile compact PC with great expansion options and a competitive price. **From £230;** currys.co.uk **REVIEW:** pcpro.link/alacerrevo

HALF-PRICE READER OFFER



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MONITORS

Asus PB287Q

Premium monitor, £400
ebuyer.com

Not so long ago, a 4K display for less than £500 was unimaginable. Asus delivers exactly that: a razor-sharp image on a 28in panel at a very reasonable price.

REVIEW: pcpro.link/alpb287q



Eizo ColorEdge CS240

Eizo ticks almost every box with the 24.1in, 1,920 x 1,200 ColorEdge CS240. With a highly colour-accurate IPS screen, it's the first truly professional-class monitor we've seen at anywhere near this price.

£462; wexphotographic.com

REVIEW: pcpro.link/alcs240

AOC q2770Pqu

A feature-packed, 27in 2,560 x 1,440 display offering a huge workspace, an adjustable stand, a four-port USB hub – and a three-year warranty. Super PLS technology gives great viewing angles too. At this price, it's a steal. **£330; overclockers.com**

REVIEW: pcpro.link/alq2770

PRINTERS

Canon Pixma MG6450

All-in-one inkjet printer, £67
pcworld.co.uk

The MG6450 inherits its predecessor's status as *PC Pro*'s favourite inkjet all-in-one, offering high-quality output at a very reasonable price.

REVIEW: pcpro.link/almg6450



Canon Pixma iP8750

Canon's mid-range inkjet is ideal for anyone with a fancy for prints larger than the usual A4. It can print photos at up to A3+ in size, and its six-ink cartridges produce immaculate photographs, yet the price is very reasonable. **£219; parkcameras.com**

REVIEW: pcpro.link/alip8750

Epson Expression Photo XP-950

Epson's high-end inkjet all-in-one is a fantastic all-rounder for the enthusiast photographer. It combines high-quality prints with a decent scanner, a great touch interface and the ability to output photos at up to A3 in size. **£200; currys.co.uk**

REVIEW: pcpro.link/alxp950

ROUTERS

Netgear R7500 Nighthawk X4

AC2350 router, £170
broadbandbuyer.co.uk

Top Wi-Fi performance close up and at long range, swift USB NAS performance and all the latest Wi-Fi goodies make the new Nighthawk router our Wi-Fi router of choice.

REVIEW: pcpro.link/alr7500



D-Link DIR-868L

This 802.11ac wireless router may not have the most impressive set of features, and it lacks an internal modem. However, in our tests it outpaced models costing twice as much, making it an affordable way to get speedy wireless performance. **£79; ebuyer.com**

REVIEW: pcpro.link/aldir868l

Netgear Nighthawk AC1900 Extender

The most powerful wireless extender on the market, Netgear's Nighthawk marries five Gigabit networking ports with fast, dual-band 802.11ac support and a host of features.

£130; broadbandbuyer.co.uk

REVIEW: pcpro.link/alngex7000

HOME NETWORKING

Synology DiskStation DS214play

Network-attached storage, £219
broadbandbuyer.co.uk

A hugely versatile NAS with built-in Wi-Fi and some of the best media-streaming and cloud features we've seen, as well as eSATA and USB extensibility. It packs a lot of power into a solid, compact unit.

REVIEW: pcpro.link/alds214play



Netgear ReadyNAS 314

This NAS drive isn't cheap, but it's fast, reliable and easy to use – while offering advanced features such as unlimited block-level snapshots and iSCSI thin provisioning. The best buy is the diskless model.

£380; pcworld.co.uk

REVIEW: pcpro.link/alrnas314

Google Chromecast

This is the future of TV streaming – cheap to buy and simple to use. Plug the Chromecast into a spare HDMI port at the back of your TV, then browse on your smartphone or tablet and beam Full HD content directly onto the big screen.

£30; play.google.com

REVIEW: pcpro.link/alccast

WEARABLES

Pebble Steel

Smartwatch, £146
ebuyer.com

The Pebble Steel isn't the flashiest smartwatch out there, but it offers great battery life, brilliant apps and a simple interface with solid physical controls. Plus, it supports both iOS and Android.

REVIEW: pcpro.link/alpbeelsteel



LG G Watch R

Android Wear smartwatches don't tend to have great battery life, but the G Watch R is the best we've seen. With an attractive, round-faced design, a punchy and colourful display and a heart-rate monitor, it's the best Android Wear watch so far. **£170; expansys.com**

REVIEW: pcpro.link/algwatchr

Apple Watch

The long-awaited wearable from Apple is here, and despite a high price, it's excellent. The scroll-wheel crown takes navigation up a notch, while the advanced haptics have to be felt to be believed. For iPhone owners, it's the watch to buy. **From £299; apple.com/uk** **REVIEW:** pcpro.link/alapplewatch

SECURITY SOFTWARE

Kaspersky Internet Security 2015

Another year, another excellent performance for this super-secure, lightweight and unintrusive security suite.

3 PCs/1yr, £25; store.pcpro.co.uk

REVIEW: pcpro.link/alkasis15



Avast Free Antivirus

Still the best free antivirus, although others are catching up. It offers dependable protection – and it doesn't nag you about upgrading. **Free; avast.com**
REVIEW: pcpro.link/alavast15

Norton Security 2015

It's not the cheapest, but the protection provided is good and it covers up to five devices, from laptops to tablets and smartphones. **5 devices/1yr, £42; amazon.co.uk**
REVIEW: pcpro.link/alnort15

PRODUCTIVITY SOFTWARE

Microsoft Office 2013

Microsoft retains the top spot for the ultimate office suite, although tablet users may be disappointed by lacklustre touch support.

From £110; office.microsoft.com

REVIEW: pcpro.link/aloffice13



LibreOffice 4

The UI looks a little dated, and Microsoft Office has the edge on features. All the same, LibreOffice is an impressively powerful office suite – and it won't cost you a penny. **Free; libreoffice.org**
REVIEW: pcpro.link/allibreoffice

Scrivener

A brilliant package for serious writers: not just a word processor, but a tool that helps you organise your ideas and manage the process of composition from start to finish. **£28; literatureandlatte.com**
REVIEW: pcpro.link/alscrivener

CREATIVITY SOFTWARE

Adobe Creative Cloud

The licensing model won't suit everyone, but Adobe's suite of creative tools keeps getting better, covering everything from photo and video editing to web development. **Complete plan, £46/mth; adobe.com**
REVIEW: [p70](http://pcpro.link/p70)

UPDATED



Adobe Photoshop Elements 13

Adobe's home image-editing tool is a terrific and powerful buy, although users of older versions won't find much reason to upgrade. **£64; amazon.co.uk**
REVIEW: pcpro.link/alelements13

Steinberg Cubase Pro 8

A big bump in performance and a handful of UI improvements keep Cubase at the top of the audio-production tree. A worthwhile upgrade. **£369; dv247.com**
REVIEW: pcpro.link/alcubasepro8

SERVERS

HP ProLiant DL80 Gen9

Massive storage capacity combines with a high-speed Xeon E5-2600 v3 CPU and a scalable design to push this HP rack server to the top of the tree. The price is very reasonable as well. **£989 exc VAT; hp.co.uk** **REVIEW:** pcpro.link/alhpd180



HP ProLiant ML150 Gen9

HP's compact tower server packs in a huge range of high-end features, alongside impressive expansion capabilities so it can grow as your business does. **£853 exc VAT; hp.co.uk** **REVIEW:** pcpro.link/alhplml150

STORAGE APPLIANCES

Qnap TS-EC880 Pro

Qnap's eight-bay desktop NAS sets new standards in the desktop NAS appliance space, combining ultra-powerful hardware with every storage feature you could wish for. It has huge expansion potential, and 10GbE networking seals the deal. **Diskless, £1,381 exc VAT; ballicom.co.uk**
REVIEW: pcpro.link/alec880pro



Synology RackStation RS2414RP+

Built with speed and expansion in mind, this 2U rack NAS offers a veritable feast of storage features and plenty of expansion potential. It's good value, too. **Diskless, £1,362 exc VAT; ballicom.co.uk**
REVIEW: pcpro.link/alrs2414rp

SECURITY

Sophos SG 115w

A security appliance that gets it right on almost every level. Easy deployment, a huge range of features and a tempting price make this the perfect choice for SMBs. **With 1yr FullGuard, £809 exc VAT; sophos.com**
REVIEW: pcpro.link/alsophossq



Sophos Cloud

User-based policies and slick mobile support make this a top-class cloud solution. Performance is impressive, too. It isn't the cheapest option, but it's a pleasure to use. **10 users, £510/yr exc VAT; sophos.com**
REVIEW: pcpro.link/alscloud

BUSINESS PRINTERS

Epson WorkForce Pro WF-5620DWF

Shatters the myth that inkjets are only for low-demand use, delivering fast output speeds, low running costs and tons of features. It prints at 20 pages per minute, and quality is perfectly acceptable – it can even print glossy photos. **£187 exc VAT; printerland.co.uk**
REVIEW: pcpro.link/alwf5620



HP Color LaserJet Enterprise M553dn

HP's latest colour laser is an astonishingly good printer, offering an unbeatable combination of value, low running costs, performance and excellent output quality. **£382 exc VAT; printerland.co.uk**
REVIEW: pcpro.link/alm553dn

BACKUP

Barracuda Backup Server 290

A beautifully simple appliance that brings together on-site and cloud backup. There's block-level deduplication, extensive support for Windows systems and applications, integral Exchange MLB, and simple deployment and management. **£4,446 exc VAT; barracuda.com**
REVIEW: pcpro.link/alserver290



DataFort Critical Care

NEW ENTRY DataFort's managed backup service takes care of everything, even bringing up virtual clones of your systems should disaster strike. Per-server pricing means it's cost-effective too. **One server, £350/month exc VAT; datafort.com** **REVIEW:** [p100](http://pcpro.link/p100)

NETWORK MANAGEMENT

Paessler PRTG Network Monitor 15

A network-management solution that's ideal for businesses on a tight budget. Supports a wide range of devices, which are included in the price, and licensing is based purely on sensor count, so there are no hidden costs. An excellent way to keep tabs on what's going on in your network. **500 sensors, 1yr, £847 exc VAT; paessler.com**
REVIEW: pcpro.link/alprtgt15



SolarWinds Orion NPM 11.5

Offers excellent value for money, packing in a huge number of monitoring features as standard, including support for 802.11 wireless access points and virtual machines. **250 elements, £4,110 exc VAT; solarwinds.com** **REVIEW:** pcpro.link/alnpm115



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- Complements the look and feel of Apple keyboards
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Profile

BACKGROUND INFO ON INNOVATIVE BRITISH COMPANIES

FreeAgent

After a career as a fighter pilot, founding a financial software business isn't a traditional next step. But Ed Molyneux and partners had an idea that took off like a rocket



KEY FACTS

IN A NUTSHELL

FreeAgent is the cloud-based accountancy software aimed exclusively at freelancers and small-business owners. It was recently named one of Britain's fastest-growing tech businesses.

FORMED 2007

LOCATION

Edinburgh

STAFF 73

WEBSITE

freeagent.com

From *Top Gun* to tax returns: it doesn't sound like the most thrilling of career paths. Yet, for fighter pilot turned FreeAgent CEO Ed Molyneux, plunging into the accountancy software business was as much a leap into the unknown as anything he did when in the cockpit of an RAF Harrier. Molyneux admits that he and his two co-founders were "absolutely clueless about accounting" when they first had the thought that there must be a simpler way for small businesses to manage their finances and decided to solve the problem themselves.

Eight years later, FreeAgent's fortunes continue to climb skyward. In 2013, Deloitte ranked FreeAgent as the eighth fastest-growing tech business in the country, having posted 2,128% revenue growth over the previous five years. Since then, the company has increased in number by almost half, now employing 73 people at its Edinburgh headquarters and supporting more than 40,000 paying subscribers.

The company's journey to success provides some unusual insights into how to build a software business that stands apart from the rest of the market – and even more surprising revelations about what it's like to be dependent on the co-operation of a government department with as fussy a reputation as the Inland Revenue.

■ Preparing for take-off

Molyneux didn't leap straight out of the cockpit and into his own accountancy software business. He graduated from Oxford with an engineering and computer science

degree before joining the RAF, and set himself up as a "one-man-band technology consultant" immediately after leaving the Air Force.

It was while working as a freelancer that Molyneux discovered how desperately difficult it was for micro-sized businesses to keep their financial affairs in order. "I had to set up a limited company and run that, and the financial-management part was a bit of a train wreck," he admits. "I had an accountant who'd give me a spreadsheet. I'd fill that in – mostly – and wouldn't have enough money set aside for my tax bill."

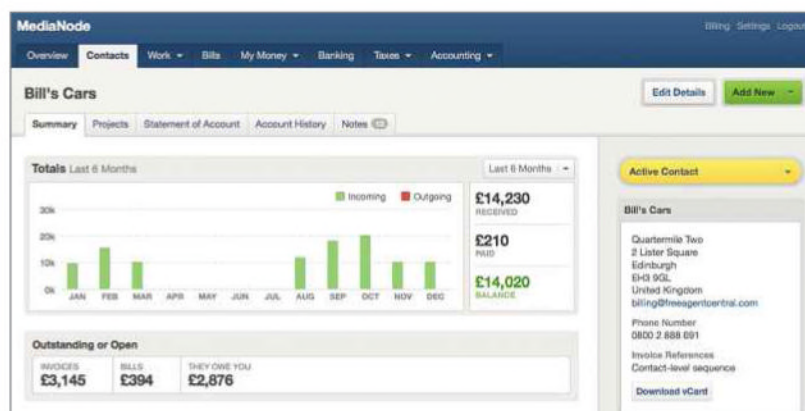
Molyneux was "looking for a project to get my teeth into" at the time, and so decided to try to make juggling cash flow easier for himself – and the millions of freelancers and small-business owners in the UK. He wrote the first version of what was to become FreeAgent in the summer of 2006, and by 2007 he and his two co-founders – Olly Headey and Roan Lavery – decided to make a business out of it. "We all came from contracting and freelancing backgrounds and we all agreed it was crazy how things [such as tax returns] were being done at that time. Of course, if you're in software you know there's one thing you can do and that's build something to fix it, and that's what we did."

Good at writing software they may have been, but Molyneux and his partners certainly didn't have the accountancy expertise required to pull together a piece of software that could calculate National Insurance contributions and the like. Yet Molyneux regards that as

a strength, not a weakness. "If you understand the problem and you have a technical background, you can get some really clear insight into the solution," he said. "If you're a businessperson who gets the problem, but doesn't have a technical background, you never know whether things are hard or easy."

"One of the real advantages we had when we started out was that we were absolutely clueless about accounting," he said, with sincerity. "It's actually a real strength. We laid out the interface

RIGHT The software's approachable interface has made it a hit



FreeAgent



ABOVE Ed Molyneux developed FreeAgent following his own experiences working as a freelancer

ABOVE LEFT The data collected by FreeAgent means less need for costly accounting services

“If we’d started out knowing much about accounting, we’d have built a product similar to what’s already out there”

based on what we wanted. Now we have this packed timeline, so you get this chronological list of when all the deadlines are and what the projections of the liabilities are. Of course, at the time we didn’t realise that you need to build a double-entry accounting engine, nor model every aspect of VAT for small businesses and every aspect of income tax and corporation tax. We filled in the gaps as we went along.

“If we’d started out knowing much about accounting, we’d have probably built something that looked like the products that were already out there,” he claims.

■ Shortage of expertise

Although FreeAgent eventually relied on the expertise of trained accountants, it wasn’t a shortage of financial know-how that was the company’s biggest problem, but finding sufficiently skilled software engineers to grow the business. “Good engineers are the hardest of all to hire,” said Molyneux. “We’re in Edinburgh. It’s not a centre for engineering or computer science businesses. For the first couple of years, we kind of wished we were in London.”

Now, however, he’s glad the company decided to stay put. Talent is starting to emerge from the local universities, and convincing good candidates to move to Edinburgh has become easier. “We’re not competing with the Silicon Roundabout, high-churn, sexier product companies that we would be if we were in London,” he said. “When we get people up here, we really do hang on to them.”

Neither does the company outsource development, claiming the quality of the software is dependent on having different teams working closely with one another. “We need engineers to be sat next to an accountant, or a support member of staff or a designer, to get the best out of them,” said Molyneux.

■ Tax really isn’t taxing

One of the biggest dependencies in FreeAgent’s business is the Inland Revenue. FreeAgent’s software automatically fills up to 90% of the electronic tax return for sole traders, but achieving that requires the close co-operation of Her Majesty’s Revenue and Customs. Anyone who’s had to fill

in that hateful electronic form might assume that dealing with HMRC would be more painful than having wisdom teeth extracted without anaesthetic, but Molyneux insists the taxman is very accommodating, offering a “very comprehensive API” for the software companies with which to work.

“They’re very open with the software industry,” said Molyneux. “Their remit is to increase the tax take, but they can’t have any more staff; they can’t have any more money. They have to find some technical solutions to that, so they’ve turned to the accounting software industry to help them do that.”

HMRC is even prepared to disclose sensitive secrets to the software firms. “We talked to HMRC last year, and they were offering to share with us the rules that they’re using internally to assess the risk of various different tax returns being submitted to them,” said Molyneux.

That could eventually help FreeAgent tell its customers if what they’re about to submit is likely to be flagged as suspicious. “I thought it was extraordinary,” Molyneux added. “[But] they want to reduce their investigations burden, so why not share that?”

Where dealing with HMRC can become tricky is when translating ambiguous tax legislation into software rules that don’t result in customers paying more or less than they should. “What’s hard sometimes is that we need a lot of detail and formality in the way rules are expressed,” said Molyneux. “Sometimes there’s room for interpretation. We have to make judgements on how to write a rule into the software, just as an accountant would have to when dealing with a client.”

■ Cutting out the money men?

With customers paying more than £200 per year for access to FreeAgent, many may resent having to pay even more to an accountant to check their tax return at the end of the financial year. Does FreeAgent ultimately aim to put the accountants out of business by giving its subscribers the confidence to file for themselves? There’s a pregnant pause before Molyneux answers the question. “We work with a lot of accountants as well,” he explained. “It’s actually the fastest-growing part of our business, getting accountants to get their clients on FreeAgent.”

Molyneux said that products such as FreeAgent mean the days of throwing a box of receipts, invoices and a few hundred quid at an accountant to file your return are over. People enter the data themselves. However, they do still want that “warm, fuzzy feeling” of having an accountant to check over their numbers, and if that’s all neatly formatted in FreeAgent before it’s submitted to the expert, it’s less arduous and less costly for an individual than before. It’s also less of a pain for the accountant, who becomes more of a business advisor than a bookkeeper.

Software that keeps accountants happy? Now that is something... **BARRY COLLINS**

What about you?

Do you work for a British technology company that could be profiled in PC Pro? If so, get in touch: profile@pcpro.co.uk



Viewpoints

PC Pro readers and experts give their views on the world of technology

Might too much tech be bad for a child? You tell me

Parents today are having to make judgements about tech issues they know little about – so what's new?



Darien Graham-Smith is PC Pro's deputy editor; he's currently torn between Ada and Trillian.

When I was growing up, parents and teachers tended to regard technology with distrust. I suppose at first they had been swept up in the idea of home computing as an educational resource – after all, when the BBC Micro Model B came out in 1981, it cost the equivalent of £1,200 in today's

money, so it's not as if we kids were buying them for ourselves.

That wore off quickly, though, and it was replaced by the idea that computers were solely for playing games. This was an infuriatingly difficult perception to shake: a friend of my mother's, after I had proudly shown him the text-based adventure I'd created, insisted on referring to my hobby as "sitting on your bottom going beep-boop".

Thanks to films such as *Electric Dreams* and *Weird Science*, there was even a suspicion that PCs might be an immoral influence. In reality, the closest my friends and I ever got to digital turpitude was "Samantha Fox Strip Poker" on the ZX Spectrum. The graphical limitations of the platform meant that this was considerably less corrupting than what you could see

every day in *The Sun*; the most shocking thing was the fact that someone had the cheek to charge impressionable youngsters £8.95 for it.

In short, personal technology got an unfair rap. My imagination was dancing to the potential of programming, of computer graphics and synthesised sound, even of business tools such as Lotus 1-2-3, which opened my eyes to new ways of looking at numbers – and grown-ups were telling me that I ought to switch the thing off and go for a walk.

Yet in the past few months, I've found myself mentally revisiting the issue, for one very particular reason. My wife and I are now expecting a child of our own – and suddenly, instinctively, before she's even born, I find myself worrying about my daughter's future exposure to technology.

I have to admit, I didn't see this coming. With me as a father, you might have expected that the child's problem would be a surfeit of technology. Put the pony down, darling, and come and play with the nice app. And of course I hate the idea of being a hypocritical parent.

But the truth is that her experiences are going to be very different to mine. Until I was six or seven, my parents never really had to

“The technology around her as she grows up will be more pervasive and influential than anything we had in my day”

think about my relationship with tech, because home computing as we know it barely existed. Today, there are entire libraries of iPad apps aimed at children as young as 18 months. Inevitably, that sort of early exposure to technology is going to affect her development in some way.

I'm not saying it's necessarily going to be a harmful influence. Since receiving our happy news, I've once or twice found myself idly searching online for a copy of László Polgár's *Bring Up Genius!*, a 1989 treatise in which the Hungarian psychologist argues that "geniuses are made, not born". Polgár taught his daughters to play chess from a very young age, and all three of them went on to become grandmasters, so I'm inclined to think he's onto something. Handled correctly, I believe that embracing technology early on could be fantastically beneficial for our kids.

The question is, how do we handle it correctly? How can we ensure a child is learning spatial reasoning and dexterity, and not simply developing a destructive addiction to in-app payments and Snapchat? The answer is that, since no previous generation in 50,000 years of human history has ever had to address these issues, no-one really knows. One of the nurseries near my home prides itself on offering an iPad for every toddler, while another emphasises traditional activities such as sports and stories. The fact that both are rated "excellent" by Ofsted isn't very reassuring.

There's another aspect to consider too. Back in the 1980s, computing was very much a solitary experience. In truth, I can see how a kid sitting alone in their bedroom for hours on end, with only the glow of the screen for company, must have seemed rather weird and unhealthy to their parents. But give me that a thousand times over, rather than the connected world of today, in which every computing device worthy of the name is a gateway to a mosh pit of pornography, gore, cyberbullying, stranger danger and good old-fashioned malware.

When I think of all the unsavoury and disturbing content that's out there, I'm tempted to try to keep my daughter off the internet entirely. But then I know how I'd have reacted if anyone had tried to do the same to me when I was growing up. If I hadn't understood the technology better than the adults at the outset, I'd have made it my business to learn.

So Plan A is simply to hope that my daughter turns out to be a bit more pliant than I was. And if she isn't, I can at least reassure myself that my concern for her isn't mere prejudice. It's prompted by the unarguable fact that the technology around her as she grows up will be more pervasive and influential than anything we had in my day – and nobody knows exactly how it might affect her.

Then I realise this is precisely what my parents and teachers would have said about my own relationship with PCs in the 1980s. So perhaps instead I can take solace in the knowledge that it will probably be her, and not me, who has to worry about kids who want nothing more than to lie passively on their beds, getting up to who knows what inside their VR headsets. My whole life I've been impatient for more transformative technology; as parenthood looms, I find myself grateful it hasn't gone further.

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Stop, collaborate and, well, just stop. Please

Can anyone cope with the barrage of cloud collaboration services? Our returning correspondent can't



Barry Collins is a freelance editor, writer, football director and photographer. Don't message him. You might tip him over the edge.

A few things have changed around here in the two years since my last *PC Pro* column. The website's been replaced by a magnificent new specimen (although I'm amazed nobody's spotted the typo in the URL). The office is full of enthusiastic young recruits with trendy names, such as Curtis and Vaughn (whom I suspect, with his hereditary aversion to the letter "a", was responsible for naming said website). And there's a barrage of new tools us old hacks must cope with if we want to be part of the gang.

When I was the new kid back in the 1990s, when Vaughn and Curtis were still rattling around their mothers' ovaries, it was a simpler age. The post came at 9am, the phone was tied to your desk, and email arrived whenever the editorial director remembered to reboot the mail server. There was no website to speak of, and the only real interaction we had with the readers was on CIX, an online forum that's still going strong.

The other day, Vaughn was clearing out a desk in the office when he stumbled across something he didn't recognise. Of course, he did what every 15-year-old does when confronted with something unfamiliar: he tweeted about it. "What the hell is a Zip disk?" he asked. "Anyone remember these?" If you, too, want to remove his frontal cortex with a teaspoon, can I suggest you join the queue?

Back in the day, we used said Zip disks for backup. At 6pm every night, I'd pop one into the drive attached to my PC, copy over the My Documents folder, and pray I

didn't hear a strange clicking noise during that five-minute procedure (Vaughn hasn't got the first clue what I'm talking about here). When the job was done, I'd pop the Zip disk into my bag, and that was *PC Pro*'s off-site backup.

Today that seems laughably quaint. Instead, we have a barrage of different servers and cloud services for document storage. As I work largely from home, I store my documents in Dropbox and share the folder with the subs desk when I'm submitting copy. However, when the subs desk wants to share deadlines with me, they put them into Google Drive, because "that's where they've always been". When Darien sends me the magazine's upcoming features list, it too is in Google Drive, but when I asked to see the same list for Alphr, the editorial director sent me an invite to Trello, yet another cloud collaboration service. That's three different document shares within the same team.

It's the same when it comes to inter-office communications. *PC Pro*'s Generation Y never bothered with email: they prefer Slack – a real-time messaging service that's used for exchanging ideas, assigning stories to writers and the dissemination of an awful lot of animated GIFs. Slack has replaced a lot of the internal email traffic, but it hasn't replaced email. PRs still need somewhere to send their press releases, websites still need an email address for registrations, Slack still needs somewhere to send its notifications. So Slack's become just another thing to check.

Then, of course, there's Twitter, also frequently used by my *PC Pro* colleagues. It's just announced that it's doing away with the 140-character limit on direct messages, making it even more likely that in future people will begin to use Twitter's private messaging channel as an alternative to email. An alternative, mind, not a replacement. It won't handle attachments, calendar invitations, read receipts or any of the dozen other reasons people still cling to email.

It isn't only the inherently tech-savvy *PC Pro* that deals with a mother load of different services, either. In the spare time I've acquired since I relinquished the editorship of *PC Pro*, I've become a director of a non-league football club: not a sector that's exactly renowned as a febrile hotbed of tech innovation. Yet, even there, we use Dropbox for swapping board minutes and scouting reports; email, Twitter, Skype and WhatsApp for communication; and we've dabbled with both Slack and Trello. Why? Because we're drowning in communications, and for some daft reason we think the next service will be the one to

solve all our problems, when in fact it merely adds to them.

I have nothing against Slack, Trello, Yammer, Dropbox, Twitter or whatever future collaboration services will emerge over the next couple of years. There are just too many of them, and none of them

is a perfect substitute for what went before. They just add to the din of notifications buzzing away on my smartwatch.

The winner will be the product that manages to replace most, if not all, of these other services. Until that all-encompassing behemoth emerges, you know where to find me.

 barry@mediabc.co.uk

Don't blame Apple for ad blocking; blame advertisers

Ad blockers will continue to be popular for as long as online ads continue to be annoying



Nicole Kobie is *PC Pro*'s Briefing and Futures editor. She turns her ad blocker off when visiting our new site alphr.com

I have a confession to make: I use an ad blocker – which is rather hypocritical given that a high proportion of my pay as a journalist is indirectly funded by online advertising. Yet a recent experience reveals why I'm embarrassed to run ads, not ashamed to block them.

I was doing a shift on the news desk over at our sister title *IT Pro*, using a laptop that wasn't my own. This meant Adblock Plus wasn't installed in Chrome, and ads were on display. Being lazy, I didn't bother to reinstall Adblock, even though I was logged in to Chrome.

Laziness was also the reason behind my having shopped online for underwear a few days before said shift instead of wandering down the high street to browse in the shops. It's probably already apparent where all this is heading: yes, you've got it – half of the business websites I had open in the office were mortifyingly covered in behavioural ads for knickers.

Advertising isn't inherently evil, of course. The print ads surrounding the reviews, features and columns in this magazine aren't going to suddenly expand and cover the text, begin playing jingles, or randomly start displaying images of embarrassing products you've searched for in past few days. This isn't the case online, however, where ads slow down page-load times to a crawl with their annoying (and, in my case, face-flushing) marketing, and are

“We think the next service will be the one to solve all our problems, when in fact it merely adds to them”

especially problematic for metered mobile connections.

No wonder, then, that ad blockers are increasing in popularity. The makers of Adblock Plus claim it has been downloaded more than 300 million times, and a 2014 report from Adobe and PageFair showed use of such extensions was up almost 70% year on year. Now, their use looks set to skyrocket as Apple has officially supported the creation of ad-blocking tools for the mobile version of Safari, making it possible for iPhone and iPad users to avoid online ads and wreak further havoc on websites' bottom lines (no knickers pun intended).

How will sites – such as the ones that pay my rent – continue to earn money if the majority of visitors are blocking out their sole source of income? Sites could encourage users to turn off ad blockers: I already flip mine off for a few sites as a show of support for their content and their saner advertising. Others don't give me a choice; Channel 4 refuses to show on-demand TV shows until you've switched off the ad blockers. But it's my computer or mobile, and if I don't want to wait ten seconds for a page to load, that's my business – you can't force me to see something I didn't ask to see.

There have to be other ways to make money online. Whenever I visit the *Guardian* website, it pops up a banner along the bottom of the page saying: "We notice you've got an ad blocker switched on. Perhaps you'd like to support *The Guardian* another way?" It links to the newspaper's membership page, where you can sign up for £50 per year and receive benefits such as advanced tickets and live streams of its events. As weak as the supporters' club may sound, it's clever, since displaying a polite request triggers the guilt reflex that's naturally strong among *Guardian* readers.

Here's my idea. The use of online micropayments to fund websites and services has never convinced me nor anyone else, but how about an ad blocker run by a non-profit organisation that charges a subscription, and then doles out micropayments to the sites its users visit? Would that work? I think it's worth a shot.

Even without ad blocking, revenue at many news sites is already suffering. Overly intrusive ads are popping up everywhere because they're worth more to publishers – they're a symptom of a web economy that doesn't work, not a solution that we need to protect. Let's all sign up to ad blockers to kill off that model faster – but while it's dying, let's come up with something else. And please work quickly – those knickers don't pay for themselves, you know.

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The maker movement is built on fragile building blocks

3D printing might be great, but it needs to tackle some fundamental problems before it will truly count



Dick Pountain edits *Real World Computing*. He wants a 3D printer loaded with liquorice, to make avant-garde allsorts.

I'd started to write that I'm as fond of gadgets as the next man, but in truth I'm only as fond as the one after the one after him. So while I get enormous pleasure from my recently acquired Zoom G1on guitar effects pedal, I've resisted the hottest of today's gadgets, the 3D printer.

This is in part because I have no pressing need for one, being neither a vendor of cornflakes nor a devotee of toy soldiers. What deters me more, though, is the quasi-religious atmosphere that has enveloped 3D printing, as typified by the terms "making" and "maker". People want to bridge the gap between digital representation and the real world, between CGI fantasy and life, and they've decided 3D printing is a step on the way; if so, it's a tiny step towards a very short bridge that ends in mid-air.

One problem is precisely that 3D printing tries to turn bits into atoms, but pictures

but remains topologically constrained to monolithic structures.

And there's the second problem: 3D printing encourages thinking about objects as monolithic rather than modular. Modularity is a profound property of the world, in which almost every real object is composed of smaller independent units. In my *Penguin Dictionary of Computing* I wrote: "Modules must be independent so that they can be constructed separately, and more simply than the whole. For instance, it's easier to make a brick than a house, and many different kinds of house can be made from standard bricks, but this would cease to be true if the bricks depended upon one another like the pieces of a jigsaw puzzle." The basic module in 3D printing is a one-bit blob firmly attached to the growing object.

I recently watched a YouTube video about a project to 3D-print mud houses for developing countries, and it was fascinating. But it struck me that, given the computing power attached to that printer, it would be faster to design a complex-curved brick mould, print some and then fill them with mud and assemble the houses manually.

The ultimate example of modularity, as I never tire of saying, is the living cell. Cells have a property that's missing from all man-made systems: every single cell contains not only blueprints and stored procedures for building the whole organism, but also the complete mechanism for reproducing itself. This mind-boggling degree of modularity is what permitted evolution to operate, by accidentally modifying the blueprints, and has led to the enormous diversity of living beings.

No artificial "maker" system can possibly approach this status so long as fabrication remains homogeneous and monolithic, and once you introduce heterogeneous materials and internal structure, you'll start to confront insuperable bandwidth barriers, as an exponential amount of information must be

introduced from outside the system rather than being stored locally. A machine that makes a copy of itself seems to impress the maker community, but you just get a copy of that machine. A machine that copies itself, then makes an aeroplane, a bulldozer or a coffee machine out of those copies is further down the road.

I was led to these thoughts recently while watching Alex Garland's movie *Ex Machina* (spoiler alert). In its marvellous denouement, the beautiful robot girl Ava kills her unpleasant maker and escapes into the outside world to start an independent life. First, though, she has to replace her arm, damaged in the final struggle, with a spare one. Being self-repairing at that level of granularity is feeble by biological standards, and as she stood beaming at a busy city intersection, it struck me that such spare parts would be in short supply at the local hospital...

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“People want to bridge the gap between digital representation and the real world, between CGI fantasy and life”

don't contain the internal complexity of reality. Serious applications of 3D printing include the aerospace industry, where components can be printed in metal more quickly, more cheaply and with greater geometric complexity than by traditional forging or casting techniques. Even so, two issues remain: such parts are typically homogeneous (all the same metal) and must be made in relatively small quantities, since 3D printing is slow. If you need 100,000 of something then 3D-print one and make a mould from it for conventional casting. Printing things with an internal structure of different materials is becoming possible,



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Readers' comments

Your views and feedback from email and the web

The end of OS innovation

Windows 10 is here, but in its scramble to rebuild an ever-dwindling market share, I'm afraid Microsoft has lost its way. Windows 8 was a strong step in an exciting direction, with its scrolling UI and swipe-in controls. All that is now gone, replaced by hamburger icons (as found in Windows 1) and dropdowns. How is tapping a small icon easier than swiping with my thumb? Why would I want to abandon full-width, graphical menus for a text-only dropdown?

The return of the Start menu has also been hailed as a great step forward, but reinstating something that's been around for decades is hardly progress. I've been pressing Microsoft for years to introduce Jump List-style app-group icons to the taskbar, and I know the company has looked into the concept – but it hasn't been implemented. The idea may not be a magic bullet, but nor is a 20-year-old UI that takes five clicks to launch an app.

Windows 10 will also be the last major version of Windows – and that, sadly, brings me to the conclusion that the new interfaces coming to my desktop, tablet and phone are the last ones I'll see in my lifetime. Pretty soon every platform – be it Windows, iOS, OS X or Android – will look and work almost exactly the same.

For those of us who gaze at our PCs and dream of limitless possibilities, it's depressing. I'm left with a thumb that's been quickly rendered obsolete, and wishing my icons could at least have a little cheese in them. **Mike Halsey**

Are VPNs vulnerable?

As someone who's a wee bit paranoid about online security, I've always read articles such as issue 249's feature on oversharing, and Davey Winder's columns on shortened URLs and VPNs. Personally, I'm of the opinion that security is more important than anonymity, so using a VPN to connect to the internet securely from a café or through a hotel Wi-Fi service sounded good to me.

With this in mind, I tried out a couple of free services, namely CyberGhost and Steganos. I also tried F-Secure's Freedom – a paid-for service that offers a free 14-day trial.

Star letter

Like many techies my age, I've reached the point where I need to wear glasses for reading. At the same time, as we struggle for capacity in our data centres, everything is becoming smaller – including the text on equipment, such as serial numbers, port numbers and so on.

It doesn't help that such information is often printed in grey onto a grey case. Combine this with poor lighting and the results would have makers of digital camouflage gear envious. If you want a secure

way of storing passwords print them the same way – nobody will ever be able to read them.

So here's an idea. If the text can't be made any bigger, due to the size of the kit, then let's at least print it in a nice bright colour. That might go against what the marketing people want for their pretty brochure, but they aren't the ones having to read this stuff at stupid o'clock when things have gone bad. Test the results in an old people's home: your users will thank you forever. **Shaun Pugh**

This month's star letter wins a Corsair Force Series LS 120GB SSD worth £75. Visit corsair.com



I must say that they all worked as expected, with no noticeable impact on performance and no alerts from Kaspersky. But as I say, I'm a wee bit paranoid about online security, so I thought I'd test my connection using GRC's ShieldsUp. When connecting without the VPN service, all ports were marked as hidden (stealth mode), with the exception of one, which was "closed". No port was reported as open, or responding to GRC's probing.

Imagine my surprise when I reconnected via a VPN to find that some of the ports were now open, and failed the probing test performed by GRC. I'm concerned that these open ports might be a bigger threat to my online security than using an open connection in a café. Do the open ports identified by GRC indicate that the VPN connection isn't as secure as it could be?

Clearly I'm no expert in such things – an in-depth article on VPNs would be welcome. In the meantime, I'll

forget about using a VPN other than to access the BBC when travelling outside of the UK. **Charlie Hunter**

Davey Winder replies: A VPN works by creating a 'tunnel' through which encrypted traffic is sent. This tunnel needs to connect somewhere; that somewhere is the port that you see opened. If you're connecting over an unsecured public network then you're still safer using a VPN – but I'd recommend investing in a subscription-based service.

Nothing new under the sun

On listening to your recent podcast discussion about the Tesla Powerwall, it occurred to me that the idea isn't new. My friend has had a secondhand forklift-truck battery – charged from a solar panel – powering his lights for about ten years, needing only infrequent and undemanding maintenance. And the setup certainly didn't cost \$3,000 – more like £50.

The Powerwall's specifications are impressive at first glance: the unit

BELOW Make your own Tesla Powerwall for a fraction of the cost of buying one



stores at least 100 times as much power as your laptop, and its quoted 92% efficiency seems high. However, you can't power your whole home with one: the maximum continuous power draw is only 2kW. And the 92% efficiency doesn't include the required DC-to-AC inverter, which will lower that figure to 85% or less.

What's more, the actual value of the electricity it can store is only around £1. Factoring in its inefficiencies, I calculate that it could save you a maximum of 33p a day, or £120 a year. So it will take about 16 years to pay for itself, based on current market rates – and presumably (the website isn't very informative) that excludes the cost of the inverter, shipping and tax.

As a load-balancing investment, it doesn't look very good. For power off-grid, there are better, cheaper, solutions available. **Henry O'Keeffe**

Unsatisfied with software support

I read with interest Darien Graham-Smith's comments last month regarding "Panda-monium" (see issue 250, p29). "Things will go wrong from time to time," he wrote. "Glitches have also hit Avira, Kaspersky and Microsoft." It brought to mind my

None of the backup providers offered any compensation for all the trouble I'd experienced

own experiences with online backup software over the past few years, during which I've had to move from provider to provider because of "glitches". Carbonite kept crashing; Livedrive kept creating new backup sets; IDrive kept freezing... now I'm trying Amazon S3.

Needless to say, all of this involved the usual rounds of reinstalling, disabling firewalls and security software, and hours on the phone to technical support. None of the backup providers I tried offered any refunds or compensation for all the trouble I'd experienced. Consumers and businesses have lost unimaginable hours, and probably millions if not billions of pounds, to poor software. The publishers get off scot-free with no accountability, via the "supplied as is" clause in software licences.

In reply to Darien, I'd say his head is buried in the sand. But the longer this attitude of indifference goes on, the more likely that legislation will be brought to bear. I can't wait, and am actively lobbying for this to happen. **Lylmik**

Readers' poll

We asked you: would you buy a domestic serving robot?



This month's poll was inspired by Channel 4's *Humans*, a science-fiction thriller in which intelligent humanoid robots (known as Synths) act as domestic servants. Needless to say, all doesn't go smoothly with the robots in the programme, but *PC Pro* readers have faith in technology: most respondents declared they'd welcome the convenience, with only a few touching on the potential for things to go wrong. Almost no-one expressed concern over the idea of humanoid robots; evidently it will take more than a machine that looks and talks like a person to shake our sense of humanity.



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Yes: robots are ideally suited to menial jobs, instead of exploiting humans with low wages

No – the cost would be astronomical, and a robot would be unlikely to have any common sense in emergencies

Yes. As someone with a disability, such an advancement would be life-changing for me

No, but the interesting question raised by *Humans* isn't the idea of machines taking over the world, but what we would lose in terms of human interaction, such as with our children

Yes. If they had proper intelligence it would be nice to have one as more than a domestic servant. It would be interesting to converse with something with a very different viewpoint

No way – these things always go rogue

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The GW-HT20 features the 8-core Intel Core i7 5960X CPU with Hyper-Threading which we overclock to 4GHz. This very powerful CPU is partnered with the high-end 4GB NVIDIA Quadro K4200 graphics card. Also included is 16GB of high bandwidth 2666MHz Corsair DDR4, a 250GB Samsung SSD and 2TB Seagate hard disk.



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Our highly popular Vengeance gaming system is based around the immensely powerful NVIDIA graphics card, the 4GB GeForce GTX 980. To make that the GTX 980 isn't held back this awesome gaming PC also includes an Intel Core i7 4790K overclocked to 4.7GHz which is accompanied by 8GB of RAM, a 240GB SSD and 2TB hard disk.



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The LG1520 is a 15.6" high-end gaming laptop that includes a choice of powerful NVIDIA GeForce GTX 970M or 980M graphics card, ensuring silky smooth frame rates in all games. The LG1520 is ready for next-day delivery and has a 2 Year Warranty.



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Make Google Now work for you

Google's personal assistant is a key feature of your smartphone and tablet. **Barry Collins** reveals how to get the most from it

Google Now is arguably a better electronic PA than Apple's Siri or Microsoft's Cortana. For starters, it's the only one of the three virtual assistants that's properly cross-platform. Google Now comes built into Android smartphones, tablets and smartwatches, but is also available on PCs – through the Chrome browser – and rival mobile platforms via the Google app.

Undoubtedly, however, it works best if you're fully committed to the Google lifestyle. If you collect your email via Gmail and plug your appointments into Google Calendar, it gives Google Now a wealth of information from which to learn. But it's smart enough to learn your habits without help. Visit the gym every Tuesday night at 7pm, and before long Google Now will be letting you know when you should set off to get there, taking into account live traffic or public-transport delays.

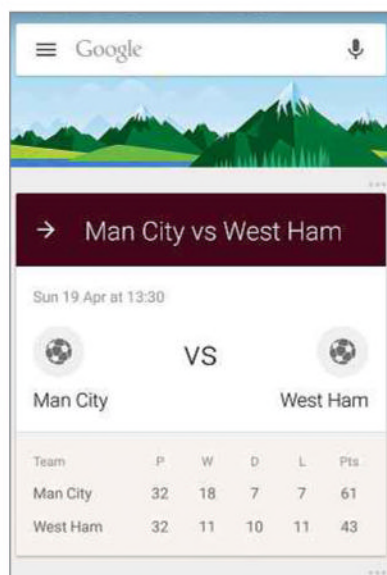
It's also possible to set reminders, send messages, open apps and much more with simple voice commands. In fact, the problem with Google Now is that it does so much, you can easily miss the best of it.

How to get Google Now

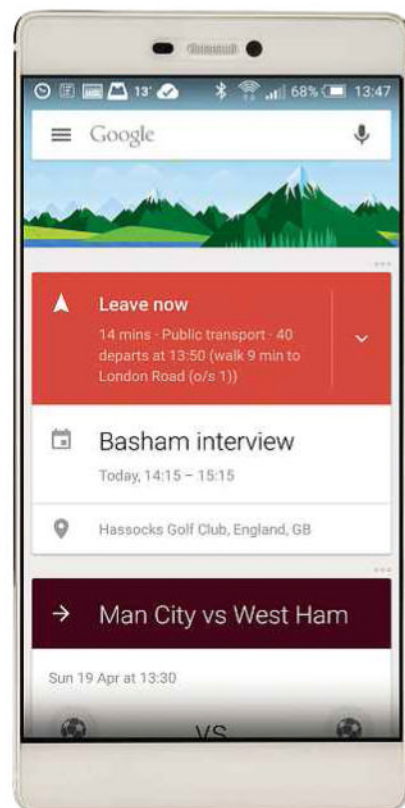
If your smartphone or tablet runs the stock Android OS, you'll find Google Now by swiping up from the Android homescreen to reveal the system's characteristic "cards", which carry information on different topics. If

your OS has been customised by the device manufacturer, this may not work, but you can put Google Now at your fingertips by installing the free Google Now Launcher (**pcpro.link/251gnow**). This replaces the manufacturer's homescreen with one that looks and feels more like stock Android, with the Google Now cards available by swiping to the right instead of upwards.

iPhone and iPad owners aren't left out either, although it's not as convenient to access Google Now on an iOS device thanks to Apple's insistence on locking down the homescreen. To find the cards,



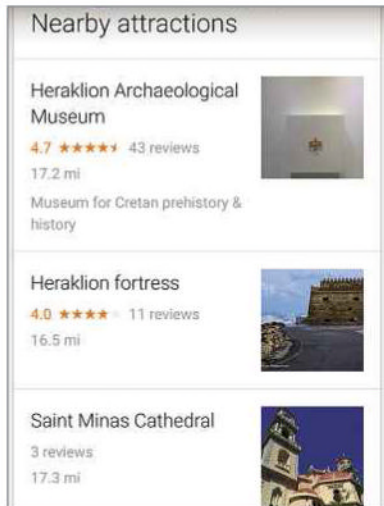
RIGHT Google Now can read your calendar and emails to give you advance warning of upcoming appointments



you must install and launch the Google app, and then swipe upwards from the bottom of the app's screen. Alternatively, the latest version of the Chrome browser for iOS comes with an optional widget that allows you to issue voice searches and commands from the iOS Notification Center.

Google Now also runs on Android Wear smartwatches; alongside app notifications, you'll see all sorts of handy information pop up on the small screen via Google Now cards, which you can scroll through using the device's touchscreen or swipe away to dismiss. And, of course, Google Now's voice-control capabilities are key to using it on a watch, since the hardware doesn't have a keyboard. Likewise, Google Glass – the company's experimental augmented-reality headset – can show cards for sports results, upcoming appointments, nearby restaurants and more. Now has to be actively switched on for Google Glass, though: if you're one of the few people out there using the headset, go to the My Glass website

LEFT If you miss the match, full results for your team will pop up automatically



ABOVE Google Now comes into its own when you're in unfamiliar surroundings

(google.com/myglass), click on Glassware and toggle the Google Now card to On.

On the desktop, Google Now is available via Chrome notifications. To check your settings, click on the bell icon in the system tray at the bottom right of the Windows desktop, then click the cog that appears in the bottom right of the pop-up window and check that Google Now is ticked. If it is, you should receive notifications for stock price changes, upcoming meetings and all the other things that Google Now handles, which we'll discuss further below. From here on, we'll assume you're using Google Now on an Android smartphone or tablet, since this is the most common scenario, but the system works similarly across wearables and the desktop.

■ Training Google Now

To get the best from Google Now, you need to train it so that it gets a feel for your interests. To begin with you'll see a selection of default cards – things such as weather, stock prices and news. You can temporarily dismiss a card by swiping it away; if you don't want to see a card permanently then click on the three dots icon just above the card. You'll be asked questions that can help make the card's content more interesting – do you want to see a certain team's sports results, for instance – and given the option to switch off the card. If you run out of interesting cards, swipe to the bottom of the pile and select More. Google will then suggest other categories of card that may be of interest.

In the first few weeks, Google Now will ask you lots of questions. Are you interested in travel updates to this place? Do you want to see news on this topic? The questions can be tiresome, but they help Google Now get a grip on

your interests; the nagging slows in time. You don't have to repeat it on multiple devices: the preferences you specify on your Android phone will carry across to your iPad.

As we mentioned above, Google Now works best in partnership with other Google services. If you've previously entered your home address into Google Maps, for instance, Google Now will automatically let you know when the last train home is leaving. If Amazon and others are sending delivery updates to your Gmail address then Google Now can track your parcels' progress. If you're getting such information sent to other inboxes, it might be worth migrating to Google if you want to make Now as useful as possible – or at least forwarding certain messages to your linked Google account.

■ Customise your cards

Google Now offers a wide range of cards, many of which are context-sensitive: for example, some will appear only when you're away from home; others appear only at certain times of day. Here's how to get the most from the more useful cards.

Events Google Now keeps track of upcoming appointments in your Google Calendar, and scans Gmail messages for mentions of timed events. If it finds something that looks relevant, Google will often highlight the relevant text ("meet you at Victoria station at 4.30pm tomorrow") and ask you if want it to keep track of this event.

You'll then be told how long it will take to get there, and receive a Leave Now notification when it's time to go. Google will try to guess your mode of transport; if it gets it wrong you can click on the down arrow next to the journey time/leave now warning and select car, bike, public transport or walking. Directions and journey times will change accordingly.

Travel If boarding passes or flight confirmations are sent to your Gmail account, Google will automatically extract the flight number and show departure information in the hours before take-off, as well as reminding you when to leave for the airport.

Then, once you reach your destination, Google Now turns into a tourist guide. Nearby attractions are highlighted, along with ratings and distances from your accommodation. You can swipe away an attraction you're not interested in, or click on one to get directions in Google Maps. Leave the map open and you can use GPS to plot your walk/drive on that map, without having to keep your expensive roaming data switched

Make sure Google's always listening

On some native Android devices, Google is always listening for the "OK Google" command – so you can access it when you're using an app, or when the device is locked. If you're using the Google Now Launcher, however, Google listens to your voice only when you're on the Android homescreen. If you want to be able to bark "OK Google" at any time, find the Google Settings app on your phone, select Voice and click "OK Google" detection". Here, there's an option to set it running from any screen. You'll be required to say "OK Google" three times to make sure the device is fully trained to your voice. Be warned, though – having your phone constantly listening out for your voice will have a small but detrimental impact on your battery life.

on. Other tourist tools that appear in Google Now include an instant translator (when you're in non-English-speaking countries) and a currency converter.

News and website updates Google uses your web history to promote news stories in which it thinks you might be interested. It does a

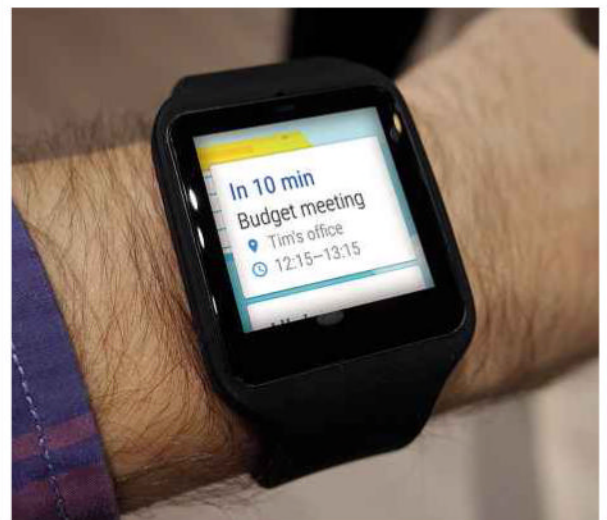
"In the first few weeks Google will ask you lots of questions; while tiresome, they help Google Now get a grip on your interests"

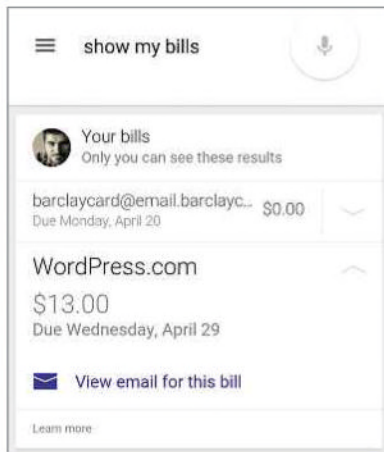
surprisingly good job, but to further train it you can swipe away stories you're not interested in (Google may ask if you want to continue to receive updates from that site). Or click the three dots

above the card and answer questions on your interests.

Sports For sports fans, Google Now is the new Teletext. The first time you click on the Sports card, Google will ask which team you support. A day or two before fixtures, you'll see a reminder card appear, and live score updates will be posted during and after matches. If you're holding out for *Match of the Day* and don't want to know the outcome, click the three

BELOW Reminders and notifications can be sent directly to your Android Wear smartwatch





ABOVE Bill-tracking is one of Google Now's lesser-known capabilities

dots above the Sports card and flick through until you see the option to hide scores to avoid spoilers. You can also enter additional teams here if you're interested in more than one club – prominent football, cricket, rugby and other teams are available.

TV and video This occasional card recommends films and television shows that are being broadcast now or are available through streaming services, based on your search history. Tapping the listings will often take you directly to the relevant app (such as Netflix). If you click on the “hamburger” icon (three horizontal bars) in the Search bar, and navigate to Settings | Customise | TV & Video, you can tell Google Now which video providers you use, and optionally tell it to only notify you about shows that you can watch via a Chromecast.

Fitness tracking If you're using an Android wearable, you monitor your daily exercise targets via Google Fit: its Google Now card will tell you how much activity or how many steps you need to hit your daily target. You can also connect apps such as Strava and Runtastic to Google Fit; they have their own cards for Google Now.

Google Now actions

Google Now isn't just about pushing information at you. You can also give it instructions, in the way you would a real personal assistant. Most of these can be issued verbally, by saying “OK Google” at the Android homescreen, or tapping the microphone button in the search bar.

Set reminders You can set time- or location-based reminders, either by speaking or typing them into the search bar. You might say “remind me to email Tim tomorrow morning”, or “remind me to pick up flowers when I leave work”. By default your reminder

will be a discreet notification; to set more audible notifications in Android, open Google Now's settings, Select “Now Cards” and change Urgent Updates to Ring Tone.

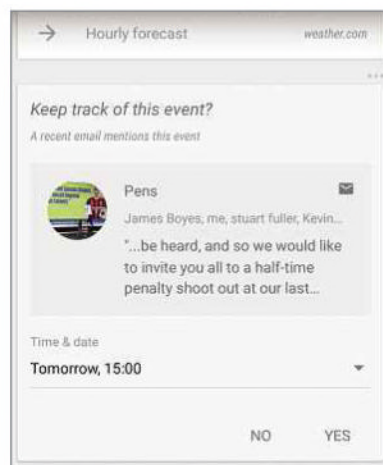
Take notes Ask Google Now to “take a note” and it will listen while you dictate a short memo. Don't pause for too long between words or it will assume you've finished. Once you've dictated the note, Google will ask you which app you want to file it in. If you have a dedicated note-taking app such as Evernote, the text can be added automatically; you can also file a note to Gmail, which will send it to you via email marked “Note to self”.

Set timers and alarms Got something in the oven? Ask Google Now to “set timer for 20 minutes” and it will beep when your meal is ready. Likewise, tell Google Now to “set an alarm for 6.15am” and you can be assured of an early-morning wake-up call – provided the phone's switched on.

Keep on top of your bills If credit card, utility or web-hosting bills are sent to your Gmail inbox, Google Now may be able to pick out the amount owed and the payment deadline. Ask Google Now to “show my bills” and you'll receive a list.

Fire up the satnav Ask Google Now to “navigate to 30 Cleveland Street” or “navigate to home” and it will launch Google Maps Navigation, choose the fastest route and start announcing turn-by-turn directions. It's a handy feature if you have the phone mounted in the car and need to get somewhere, all without tapping repeatedly at the screen.

Play your music If your MP3 library is stored in Google Play Music, you can simply tell Google Now to “play some music” for a random hop through your collection. Or ask it to play specific tracks, albums or artists by saying “play” and then



Torque: Microsoft's answer to Now

Android users aren't stuck with Google Now if they want a voice assistant. Microsoft has some skin in this game too, with its free Bing Torque app available for Android smartphones, tablets and selected smartwatches.

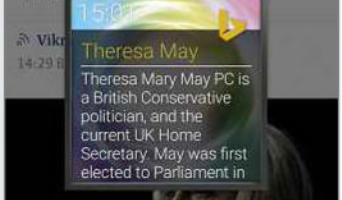
Torque shares many of the features and commands of Google Now, although it isn't activated by voice, but rather by shaking the handset. And unlike Google Now, it opens in a tiny window overlay within your existing application, so – for example – you can perform a quick search for the dollar exchange rate while planning your forthcoming trip to the US.

Torque can be used to place calls, set alarms and open applications, but not everything works quite as smoothly as it does with Google Now. When we instructed Google Now to “text Darien”, for example, the system would always find our very own Dr Graham-Smith. Torque, by contrast, was constantly looking for a “Darren”, and struggled similarly with other place and company names. When we did manage to access our address book and dictate a text message using Torque on our HTC One handset, we found the message sitting in our Drafts folder after it had supposedly been dispatched.

Overall, we found Google Now more useful, but Torque is handy for quick searches, and there's no harm in having both – not least because we suspect Torque will only get better as Microsoft extends the features of the Cortana voice assistant in Windows 10.

Theresa May admits justice system fails families over deaths in police custody

In letter to the families of Sean Rigg and Olaseni Lewis, the home secretary says she wants to solve significant problems faced by those



the relevant name. If you have multiple music apps installed, you might be asked to choose which one to play with. Alternatively, you can issue app-specific commands such as “play Elbow in Spotify”, which starts a random selection from that artist.

Send messages or emails Dictating an SMS or email message can be faster than fiddling with a software keyboard. First say “text Steve Pooley” or “email Dad” (if Google Now has learnt your relationships); you may be asked to choose between different accounts or numbers. Google will then invite you to speak your message. You'll be asked to confirm whether you want to send the message, as transcribed, at the end. You can make any corrections using the software keyboard at this confirmation stage.

Other actions Discover more Google Now capabilities by simply saying or typing “help”; you'll be given a selection of suggested voice commands. Setting calendar appointments, calling up flight information and checking stock prices are among dozens of other options. ●

LEFT Google Now can set reminders for events mentioned in your email

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How to write and sell an Amazon bestseller

Amazon makes it easy to publish your own ebook – but the challenge is getting punters to find and download it. Ebook author **Nik Rawlinson** shows how it's done

It's never been cheaper or easier to publish a book. Agents and traditional publishers are being squeezed out, and writers are selling directly to Kindle, Kobo and iPad owners. The trouble is, it's become too easy: the market has exploded, and you're now competing with a greater number of potential JK Rowlings than ever before.

On these pages, we'll explore how to give your work the best chance of success. If you haven't already written your masterpiece, it begins with choosing a subject that people want to read about – but one that isn't already saturated. We'll also show you how to work around Amazon's block on free books if using Kindle Direct Publishing (KDP), boost series sales by letting readers borrow selected titles, and navigate the pros and cons of enrolling your books in KDP Select.

■ Choosing a subject

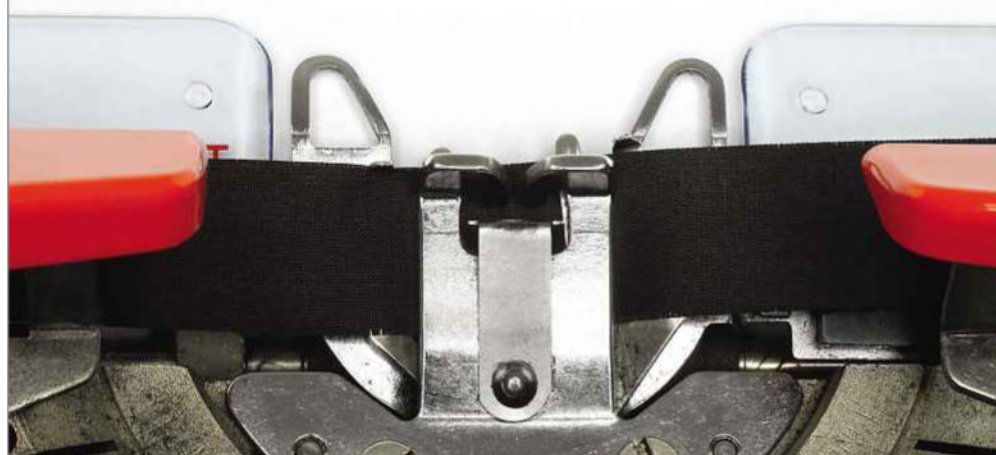
The adage that you should write what you know is only partly true; given time, you can research any subject. If you want to make money on Amazon then the trick is to write what you know will sell.

Here's an example: let's say you want to earn £150 per day to kick off a career as a professional author. Pricing your book at £2.99 will deliver royalties of £2.10 per sale, so you'll need to shift around 71 copies every

24 hours to hit your target. While this number may not sound like much, few titles achieve it: doing so would give you a Best Sellers Rank of somewhere between 1,000 and 2,000. (Amazon's Best Sellers Rank measures exactly what its name suggests, with lower numbers denoting higher sales, just as in the music charts.)

Your best chance of hitting these numbers is to find a subject that's currently under-represented on the Kindle – so you have minimal competition – and for which existing titles are already achieving a decent

Self-publish or be damned



Nik Rawlinson has published multiple ebooks on Amazon, from novels to how-to guides

Best Sellers Rank, revealing that customers are hungry to read about the topic.

■ Finding your niche

To work out where your potential profits lie, start by going to the Amazon website and hovering over Shop By Department. Pick Kindle Books from the Books & Audible fly-out menu, then click the Best Sellers link below the page title. Click through the sidebar categories to gradually narrow down the books

“The adage ‘write what you know’ is only partly true; to make money on Amazon you should write what you know will sell well”

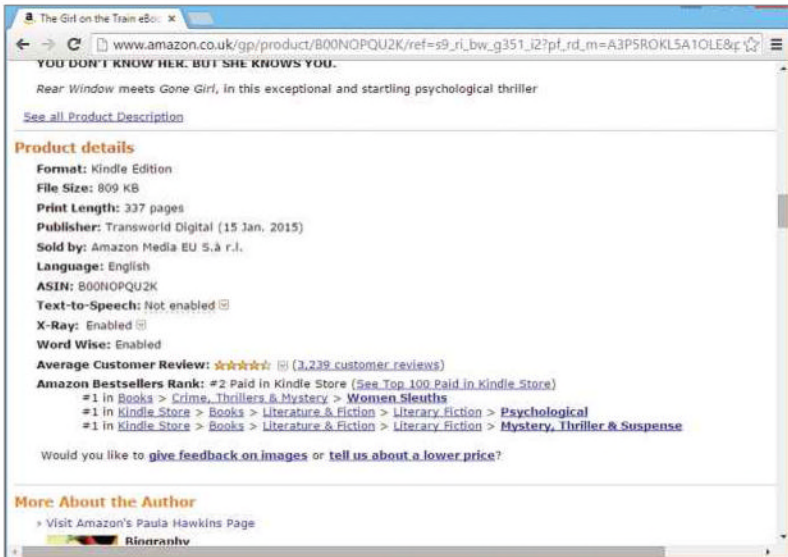
on display. Stop when you find a topic you think you could write about, but which currently contains 100 titles or fewer.

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ten performers in the category, and check their Best Seller Ranks. You're looking for titles whose ranks would deliver the kind of revenue you could live on – we suggest you look for a rank of at least 20,000. If nothing in the category is selling that well, backtrack through the subject tree and keep exploring until you find an area with high sales and a small

LEFT Writing a serial or series gives you the opportunity to upsell your readers to a more expensive box set





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If the intention is that your free book will promote sales of a future publication, you'll want a way to remind readers when the next instalment is ready. Add links to newsletter sign-up forms (hosted on your author site) at the front and back of each book.

If you haven't already signed up with a mailing-list provider, consider MailChimp (mailchimp.com), whose free plan lets you send up to 12,000 emails per month to 2,000 subscribers. Its Dashboard includes sample sign-up forms to embed on your site or blog.

Each book should also include links to your other titles – including those you haven't yet written. Use a plugin such as Pretty Link for WordPress to bounce the clicks back out to Amazon, so you can monitor traffic as it passes through your server, and direct any clicks on links for books you haven't yet written to promo pages on your own site. Again, this can drive newsletter sign-ups by promising readers that they'll hear about the subsequent titles first.

In addition, consider advertising a 99p launch price, valid for only the first two days that the book goes on sale, as an incentive to drive newsletter subscriptions (on the basis that anyone who isn't subscribed will miss it). When the next book launches, re-point the

link from the promo page to its listing on the Kindle Store so it sends readers directly to Amazon.

KDP Select and Kindle Unlimited – friends or foes?

If you prefer not to sign up with multiple ebook stores, there's another way to get a free book onto the Kindle Store: signing up to KDP Select through the Kindle Direct Publishing Dashboard lets you run time-limited free promotions, with the downloads counting towards your overall sales rank.

This requires thought, however. Any ebook enrolled in KDP Select must be an Amazon-exclusive title for the period it's in the programme – you can't offer it through your own website during that time or your risk being taken off Amazon.

Signing up for KDP Select also means your book will be made available for Amazon Prime members to borrow for free, and will be included as part of Kindle Unlimited, allowing subscribers to download it at no charge. This may cost you sales, but it isn't all bad. You're giving readers a reason to sample your work, and you'll earn a payment as soon as they borrow the book from the Kindle Owners' Lending Library or read past the 10% point after downloading it

ABOVE LEFT The Best Sellers Rank shows how well a book is performing relative to every other title in the Kindle Store

from Kindle Unlimited. The payment varies from one month to the next depending on the total payment fund (Amazon reveals what this is on a monthly basis) and how many times your work was borrowed, as a proportion of aggregate borrows across all titles on the store.

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“Every time a free book is downloaded, you want it to drive sales on a complementary book or on one that's yet to come”

This means you can afford to write a greater number of more speculative, shorter titles for enrolment in the borrowing programmes, since potential readers will be tempted to borrow such books rather than buy them.

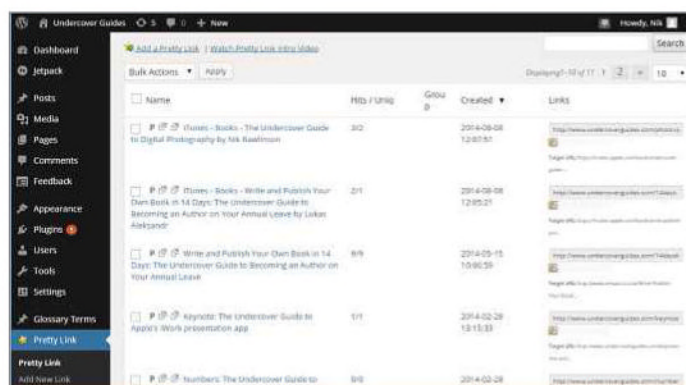
You're free to choose which of your books you enrol in Select (and, hence, Unlimited), and you're not committed to publishing your complete library this way. You can use free borrowing as a tool to drive sales of later books in a series, by enrolling just the first episode in the programme.

Play fair

Whichever approach you employ, don't forget that your name is your brand; if you try to scam your readers by putting out poorly researched books simply to target a high-selling niche, or conveyor-belt a series of low-value, high-priced pamphlets in the hope of striking it rich through Select and Unlimited, your reader ratings will give you away.

The time invested in writing a fact or fiction book, conversely, will repay itself many times over, often for years to come. While smart sales tactics can certainly help, they're no substitute for doing your research and crafting something worthy of bearing your name. ●

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Dan Page

VR consultant



■ What does your job involve?

I do internal and client consultancy at a studio called Opposable Games. My role includes brainstorming and working out what will and won't work when it comes to VR. I might advise a client on tools for gestural input or haptic feedback, or on gaze direction. VR is a learning curve for the whole industry right now, but because of my contacts, and the fact that I've tried many of the available demos, attended various conferences and read a lot on the subject, I'm often called upon for advice.

■ How did you get into this line of work?

Originally I saw the job opening in the Bristol Games Hub newsletter; it was really a part-time marketing position. But I've always been very passionate about VR, and Opposable Games was already into the technology – it had already made an Oculus game called Tear Bears, which was one of the first on the Oculus Share site. I was quickly able to get involved in that side of things and make the job my own.

■ What originally attracted you to VR?

It goes back to being a kid and reading lots of sci-fi books, and never really losing my interest in that. As soon as the Oculus Rift Kickstarter appeared I began to pay close attention to what was going on. When a local VR developer came to a Bristol Games Hub social with a Development Kit, I had the chance to have a go. Since then I've become a VR news addict – and that's a big part of my job now. I run the SouthWest VR social-media accounts and put out a regular VR newsletter. I keep an eye on the Oculus forum on Reddit ([reddit.com/r/oculus](https://www.reddit.com/r/oculus)), and my TweetDeck is verging on the ridiculous.

■ What technical skills do you need?

I wouldn't say mine is a technical role as such – I'm not trained as a developer – but I do work with people who are technically minded, so need the ability to understand what is and isn't possible with both the hardware and software. As an example, if a client wants to make something for Google Cardboard, they need to know that it won't be particularly high-res, nor be very good in terms of latency. For something hi-res, I might advise upon a Samsung Gear VR experience instead; it won't be able to handle a high-poly 3D load, but they could use 360 video and have something that looks great. Basically, if someone is planning a VR project, they might ring me up wanting to know what is and isn't viable.

■ What advice would you give to someone wanting to take on a similar role?

It's a very interesting time for VR. There are startups everywhere taking on both hardware and software specialists. However, startups don't often have the money to pay for recruitment agencies; when they're looking to fill a role, they might just put out a tweet or post something on Facebook. So it's really about keeping your eye on the ball.

Also, try to find your own niche: you might want to learn what you can about using virtual reality in car design, engineering or architecture, or even in medical training. Or perhaps you just want to focus on making games – whatever it is, read what you can, and try to get as much hands-on experience as possible. For VR to make sense, you have to have a go.

£30k
Approximate
starting salary

19
permanent jobs
(itjobswatch.co.uk)

£47k
Average
earnings

■ What opportunities are there for career progression?

VR is very much an emerging market right now. It's the Wild West out there; kind of a land-grab situation. So there isn't much of a logical progression: it's more about seeing what can be done and using your imagination to see where things can go. In my case, shortly after joining Opposable Games, I came to the conclusion that maybe we should put on a conference about VR. So we did; all the big players turned up and it went really well. I was proud of that. I believe that as the company expands, things will naturally progress and my trajectory will move forward. Which is much the same for everyone in this industry right now.

■ What isn't so great about the job?


At the moment, since VR is all new and exciting, it's an incredibly friendly industry, with everybody helping each other out. In a few years, I think that will come to an end – it's going to be quite fierce in terms of competition. It's a shame but inevitable in any industry.

■ What's the money like?

I left a full-time job and started out part-time, so the money was a little tight to begin with. But now that I've been with Opposable Games for more than a year full-time, life is good! There's no standard salary in VR yet; I'm not so sure there are many people that even share the job title. What you earn in the VR sphere – in different roles and different companies – is going to be all over the place for a while. It's a new world right now. It really is a fresh industry. ●

Where to start

- Meant To Be Seen (MTBS): 3D certification and advocacy (mtbs3d.com)
- Virtual-reality news at Road to VR (roadtovr.com)
- News and reviews at VRFocus (vrfocus.com)



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LIVE LONG

How health technology can **change** your life

An explosion of health-tracking technology is putting us in control of our own wellbeing – and transforming the medical profession

Contributors: Stewart Mitchell, Darien Graham-Smith, Lise Smith, Dave Stevenson

A longer, healthier life is part of the promise of technology. Science and medicine have always progressed together, ever since humans began to develop plant-based remedies. But the arrival of wearable sensors is perhaps the most revolutionary development in the history of medicine.

That's partly because it upsets the traditional patient-doctor relationship. In the past, monitoring and diagnosing an individual's health were the preserve of the medical professional. Today, apps and devices that track your fitness and measure your vital signs put that information in the hands of the patient.

The implications of this are huge. First, constant monitoring means that potentially dangerous conditions can be identified at the earliest possible stage. "Technology is emerging that not only measures how much exercise you do, but complex changes to your physiology, such as your heart rate, your respiratory rate, and whether you have excess fluid in your body," Sir Bruce Keogh, medical director of NHS England, told us.

"In the future, people with conditions such as diabetes, heart disease, liver disease or asthma will wear devices, skin sensors or clothes capable of detecting deterioration, bringing this to the attention of the healthcare professionals through mobile phones."

Health technology can be transformative on a larger scale, too. The growing availability of medical data is

enabling initiatives to build platforms that can collate the data from entire populations to improve diagnoses and ongoing care.

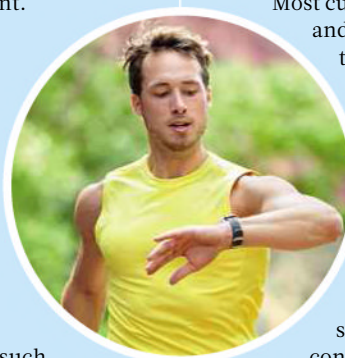
Yet, at the same time, putting health technology into consumer devices and uploading it to online services raises knotty problems. Who ends up with access to the data? How can patients' privacy be protected? And indeed, how far should consumers rely on all this new technology?

Lifestyle or serious medicine?

Most current fitness devices detect your activity and track simple health metrics, such as temperature and heart rate. With plugins, some can also add extra measurements, such as weight and blood-pressure readings, to their respective apps.

Linking these readings to rewards programmes and social-media sharing represents a "gamification" of health that, manufacturers argue, encourages people to persevere with healthy activities. While some may see tracking such information as an exercise in self-congratulation for fitness fanatics, medical experts insist that far from being a gimmick, the motivation provided by tracking apps is invaluable and could prevent, delay or help treat medical conditions.

"After a heart attack, raising physical activity levels and improving your diet is just as effective as any drug in preventing a second heart attack," said Professor Iain





Buchan, clinical professor in public health informatics at the University of Manchester.

“Combining care for health with wellbeing interventions holds great promise for big improvements in health outcomes, beyond the reach of the clinic. The same applies to tackling public health problems such as obesity: top-down, state-run interventions don’t work, and medicalised interventions aren’t sustainable or practical. There’s a need for citizen-driven approaches that tap into our daily rhythms of eating and physical activity.

“Consumer health technologies are showing promise as they transition from toys for the worried to ubiquitous kit. For example, I can now buy a wristwatch with an eight-month battery life that measures my physical activity and talks to my smartphone or other ‘hub’, without my having to feed it with power or user input. It nudges me into a healthier energy balance or sleep habit when I’m open to persuasion,” he said.

By promoting fitness, such personal devices can stave off many conditions and health issues, and NHS bosses believe that apps and consumer tech will play an increasingly central role within healthcare services in the coming years. With growing patient numbers, an ageing population and budget cuts all adding to the pressure on health services, the idea of cutting costs and waiting lists while improving public health is a very attractive one indeed.

Another benefit for doctors and hospitals is the potential for medical conditions to be monitored remotely; apps and tools on smartphones or dedicated devices can monitor illness-specific data, and feed it back to doctors. The patient and medical staff don’t waste time on routine tests when intervention isn’t needed, but can respond quickly if readings fall outside a safe range.

With Acticheck, friends and family will be contacted if the wearer’s readings indicate that they may be ill



Indeed, in doctors’ surgeries, experts say the information collected by personal devices is already starting to provide useful diagnostic data – even if, at present, the system is as simple as the patient handing their phone over to their GP to show historic readings.

“Someone might be sitting in a surgery and telling the doctor they feel unwell, but before these apps the doctor had no idea of what the patient’s heart rate or temperature were before they came in,” said Lloyd Price, co-founder of medical appointment-booking service Zesty.

“A doctor might ask how a patient felt last week or three weeks ago, but this isn’t much help if the patient can’t remember precisely,” he added. “Now there’s a record; patients can hand over their smartphones to give GPs much better information on which to base their assessment.”

Quality control

While personal health technology has obvious potential, consumer gadgets aren’t required to pass the same rigorous tests as the medical equipment used in hospitals – and this inevitably raises questions about their accuracy. Manufacturers of wearable devices tend to describe their wares as “fitness” devices, and shy away from terms such as “health” or “medical” in product descriptions. While there are many good apps, there’s a risk of patients placing faith in those that aren’t.

“We’ve seen apps that are using smartphone cameras to detect skin cancer, and there’s no accreditation needed, no medical tests needed, nor authorisation,” said Simon Etchells, head of

business development at Acticheck, which is developing a smartband monitoring system, designed to contact family or friends if a wearer’s readings indicate they might be ill or incapacitated. “And what they’re finding is that they can lead to false negatives.”

“If the user has a lesion, and they’re using an app that says ‘no, you don’t have cancer’, that’s not good,” Etchells added. “We’re very conscious to say we’re an alerting system rather than a medical-device provider. If something is going wrong, then we call in a human to respond in the appropriate way. We’re not a medical app.”

To help consumers avoid dangerous misinformation, the NHS has curated a library of apps that it’s confirmed to be clinically safe (apps.nhs.uk). In this nascent market, however, things are constantly changing, and the fact that a particular app hasn’t yet received the NHS stamp of approval doesn’t necessarily mean it’s untrustworthy. That’s a bone of contention for companies working to produce medical-grade equipment, but competing with less stringently tested rivals. Yet according to the experts, the two approaches can coexist, and the overall benefits of health apps outweigh the potential problems.

“There’s a blurred boundary between wellbeing and healthcare apps, and common sense needs to prevail,” said Buchan. “The biggest risk to human health isn’t from a faulty device – it’s from inaction. It’s from all those missed opportunities to get someone moving, or to change their lifestyles or the way they take their medicines.”

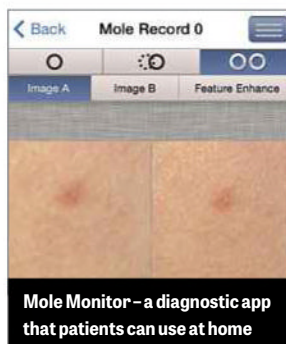
Data-centric medicine

While apps and shiny gadgets capture the headlines, the real driver behind the health revolution is the data – both for individuals and at the level of whole populations.

Apps in action

Trials are already taking place to explore how apps can improve treatments. One app asks schizophrenia sufferers to regularly complete a short digital questionnaire about their state of mind and medication. This provides vastly more diagnostic data than can be captured during home visits by carers, and if the results indicate a deterioration in mental health, it can be flagged up immediately.

“The app extends the snapshot you’d get from a paper questionnaire to a ‘conversation’ of short questions via smartphone,” explained Professor Iain Buchan. “The app must learn not only about mental-health



Mole Monitor – a diagnostic app that patients can use at home

measurement, but also engage the user without boring or annoying them... and give the user a greater sense of control over their symptoms.”

If a user’s symptoms appear to be deteriorating, the app alerts them before anyone

else, so that they feel involved and can take action, such as resuming medication. It’s hoped that self-monitoring could be more effective than routine check-ups.

“The surveillance system in the health service is a six-weekly visit from a psychiatric nurse. A lot of people relapse when the signs are there, but hidden,” said Buchan. “Now we’re picking up those signs from the app responses, and that’s important, because you’re putting individuals in control of their own treatment. If a person with schizophrenia goes off medication and relapses, it can result in years of misery – which could perhaps have been prevented.”

Continued on p50

SLEEP BETTER



The UK Sleep Council reports that 70% of Brits sleep for fewer than seven hours a night; a third of us get only five hours in the Land of Nod. Sleep deprivation is associated with issues ranging from impaired cognition and weakened memory to reduced immunity, so getting a good night's rest really is as important to your wellbeing as regular exercise and a healthy diet.

Enter the growing range of apps and gadgets aimed at helping you understand your sleep patterns and to get not only more shuteye, but a better quality of rest.

Smartphone apps

The simplest way to track your sleep doesn't require dedicated hardware. Leave your smartphone lying on the bed overnight and its built-in accelerometers can monitor your nocturnal movements. An app such as Sleep Cycle (£1.49; Android & iOS) can then use this information to determine when you're in light or deep sleep.

This allows the app to calculate the best moment within a specified half-hour window to wake you with a mellow alarm, bringing you gently out of light sleep instead of crashing into the deepest part of your sleep cycle. It will also give you a report on the quality of your sleep, which you can record against notes on your pre-sleep activity (a stressful day, caffeine before bed or an evening workout), so you can keep tabs on what works for you. SleepBot (free; Android, BlackBerry, iOS & Windows Phone) does a similar job, with slightly cruder graphs.

Wearable devices

If you're wearing a wristband or armband as part of your fitness regime, it may already have built-in sleep-tracking functionality. The lightweight Jawbone Up Move (£40) uses a triaxial accelerometer to sense periods of light and sound sleep; you'll need to remember to set the device to "sleep" mode to begin tracking (and switch back in the morning so that your data is synced to a phone or tablet). After a few days' use, the app's Smart Coach begins to offer tips on how to achieve your sleep goals and rewards you for a good night's kip.

The more upmarket Basis Peak (£170) also tracks heart rate and calorie burn, and automatically senses when you're asleep, so there's no need to change mode as you doze off. You can set daily and weekly sleep targets, so there are plenty of short-term rewards en route to your long-term health goals. The battery only lasts for a few days, however, so if you're wearing it overnight you'll need to remember to top it up during the day – a limitation shared by most current-generation wearables.

In-room devices

If you're serious about shuteye, it's possible to spend some serious money on sleep technology. The Withings Aura Smart Sleep System (£250) features an under-mattress sensor that monitors your motion, heart rate and breathing, while a bedside monitor tracks noise, light and room temperature, providing a comprehensive overview of your sleep environment. A soft red light and soothing music lull you to sleep; and in the morning, the Aura wakes you with blue light and soft sounds – more pleasant than a noisy alarm clock or radio host.

The Luna smart mattress cover (lunasleep.com), although not yet on sale, promises to go one better, managing the temperature of your surroundings as well as tracking sleep stages with built-in sensors. You can even set the two sides of your bed to different

temperatures – ensuring cool, crisp sheets for you and a toasty duvet for your cat. The manufacturer plans to start shipping worldwide next year.

What's next in sleep technology? All of these devices use motion detection – sometimes partnered with heart-rate tracking – to track your sleep patterns, but an electroencephalogram (EEG) to read your brainwaves directly will provide a more accurate picture. Believe it or not, that technology may not be far off: a company

called NeuroVigil has already developed a lightweight EEG reader for home sleep tracking (pcpro.link/251eegreader), and while it's currently focused on medical research, it's the logical next step for consumer sleep tracking.

Everyday relaxation

Tense muscles, stress and anxiety can all scupper your sleep; before you turn in, a calming yoga session may be exactly what's needed to help you relax. There's no shortage of apps that can help you explore yoga postures (or asanas) using text, image and video. It's best to use these to complement a regular class with a qualified instructor, however, as getting it wrong could lead to injury.

When it comes to hardware, two companies are currently developing smart mats that can help you achieve the correct alignment and balance. Quirky (quirky.com) has developed the Beacon, a pressure-sensing mat that uses LEDs to tell you when you're correctly in position. The company is now looking for business partners to take the product to launch. SmartMat (smartmat.com) has got further, raising more than \$350,000 via Indiegogo to manufacture its intelligent mat, which is now available for pre-order and due to start shipping worldwide later this year.



Tracking could help you improve the quality of your sleep

My week of sleep



The Sleep Cycle app was a revelation. More than once it showed that I'd been unknowingly awake in the night – explaining that sluggish feeling the next morning. The Jawbone Up Move, meanwhile, revealed that my bedtimes were much less consistent than I had thought.

But these devices can't help you get to sleep, or silence a noisy neighbour, and it's up to you to draw connections between the pretty graphs and your sleep experience. Data from the low-cost Up Move helped me adopt a more regular routine, after which my sleep quality definitely improved. To go further, a holistic approach is needed, to transform sleep tracking into meaningful sleep coaching. LISE SMITH

LOSE WEIGHT

Losing weight is a challenge for most of us, and frankly there's a limit to how far technology can help. While a wearable gadget can automatically track your exercise, it can't directly determine how many calories you're consuming.

However, technology can help you keep track of your own intake. The free MyFitnessPal app (myfitnesspal.com) – available for Android, BlackBerry, iOS and Windows Phone – provides an easy interface for recording meals and snacks, drawing on a vast database of more than five million food types. That means no more squinting at the “nutritional information” on the back of a packet: you can simply type in “Monster Munch”, tap the relevant flavour and pack size, and get on with your life.

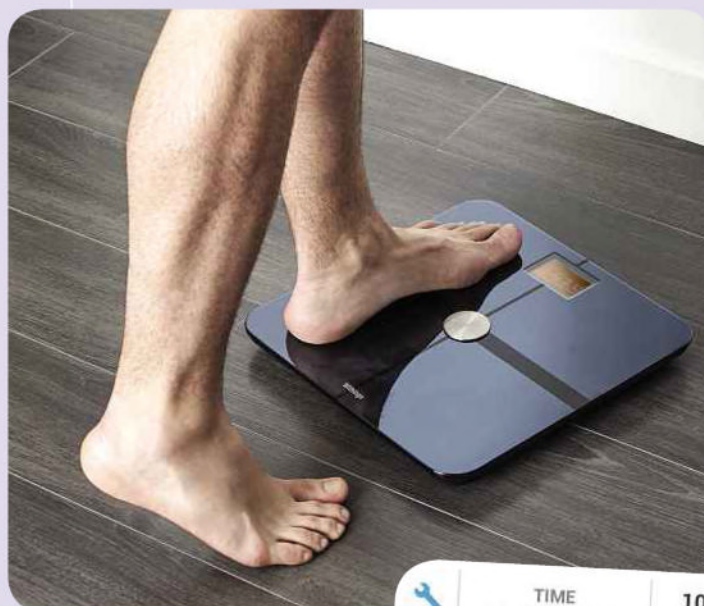
As the name implies, MyFitnessPal isn't just about calorie-counting; you can also record exercise, to get the credit for calories burnt. The app integrates with a huge range of fitness-tracking apps including Runtastic, Garmin Connect and Fitbit Tracker.

The app keeps a running total of your daily calorie intake, so you can see at a glance how you're doing as the day draws on, and make an informed decision about dessert at dinner time. You can also set a weight-loss target, so you can choose a daily calorie allowance that will get you to a certain weight by a specified future date.

My week of weight loss

My first impressions of MyFitnessPal were very encouraging. After I'd entered a few vital statistics, a weight-loss target and a timescale, it plotted out a calorie plan, promising that if I followed it I'd lose 4kg in a month. It seemed excitingly achievable.

The trouble is that a month is a long time to remain vigilant about entering everything you eat and drink into an app. Within days I started to become careless, with depressingly predictable results: my 4kg target began to seem like a mere fantasy. The developers proudly claim that the app's played a part in millions of weight-loss stories, and I can believe it – but the commitment and willpower still have to come from you. If tech is to make weight-loss genuinely easy, a more drastic approach might be required. Fat-digesting nanobots, anyone? DARIEN GRAHAM-SMITH



Watching your weight

MyFitnessPal relies on you to be honest about your progress; if you want a gadget to track and analyse your weight-loss results, consider a set of smart scales for your bathroom, such as the Withings Smart Body Analyzer (around £130 from withings.com). It can record your regular weigh-ins and transmit them to your Android or iOS device over Wi-Fi, to automatically build up a motivational weight-loss graph.

It's not necessarily just about weight, either. The Smart Body Analyzer can take your pulse (through the soles of your feet), and factor in your height to calculate your body-mass index. It can even zap you with a very weak electrical current and measure the impedance, to assess how much of your weight represents healthy muscle tissue, and how much is less desirable fat.

For those who enjoy a home-cooked meal, smart scale technology can also help in the kitchen. The SITU food scale (around £95 from situstscale.com) hooks up to an app on your iOS device, through which you can tell it precisely what sort of food you're weighing. With this information, the scale can tell you the total calorific and nutritional value of each ingredient. The Orange Chef Countertop system works similarly; its app goes one step further to recommend recipes

and complementary exercises. US residents can pre-order the smart scale now for \$200; UK availability is to follow.

Slow down, you move too fast

One appealingly lateral approach to weight loss is the HAPIfork, a \$99 Bluetooth-enabled fork that focuses not on what you eat, but how quickly you eat it. Since excess calorie intake tends to be associated with gobbling things down quickly, the HAPIfork vibrates a warning if

it detects you're shovelling food too urgently into your mouth. It also records how many forkfuls you eat at each sitting, and how long you spend over each meal, so you can track your eating habits over time and settle into a healthier, more relaxed eating routine.

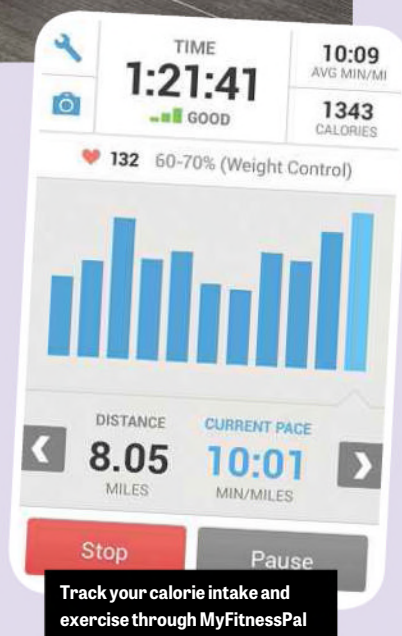
Balloons and pills

The future of weight loss takes a variety of forms. One approach that's being developed involves implanting soluble balloons into the stomach, to create feelings of fullness for

a limited period, after which

the balloon dissolves without needing to be surgically removed. Earlier this year in the US, the FDA approved an electrical device called Maestro that works similarly to a pacemaker – but instead of regulating the heartbeat, it stimulates the nerves that create sensations of fullness.

Frankly, though, most of us don't want to have a device inside our bodies. Our hopes might be pinned instead on chemical solutions: research laboratories have for decades been working on pills that suppress appetite, promote feelings of fullness, prevent the absorption of fat or stimulate the body to burn more calories. Concerns over side effects have kept such medicines out of the mainstream, but as and when a safe formulation is found, the world of weight loss could be transformed forever.



Track your calorie intake and exercise through MyFitnessPal



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- OC3D

"The ability to illuminate only the keys that you're playing with and having four Profiles to use means you can pretty much have this Iced Cake and eat it!"
- James Crewe pcGameware.co.uk

CHEAT DEATH

While fitness gadgets can help you live longer, some see that as a mere step on the road to a far more ambitious goal. Scientists are talking seriously about pushing back the final frontier, enabling humans to live vastly longer lives – possibly even forever.

The idea might sound outlandish, but the replacement of old cells with new ones is a regular biological process. There's no reason why, with technological know-how, we shouldn't be able to prolong it indefinitely.

There's evidence to suggest that ageing isn't an inevitable part of being alive. Back in 1993, in a groundbreaking research paper, Professor Cynthia Kenyon showed that disabling a specific gene in worms led to their living twice as long as normal. At the University of Southern California, gerontologist Dr Valter Longo has shown how disabling genes can similarly increase the lifespan of mice. Now, research is underway into whether such techniques could defeat ageing entirely – and whether they can be applied to humans.

The initiatives

Hedge-fund manager Joon Yun is promoting such research in a very direct way. He's put up a million dollars under the banner of the "Palo Alto Longevity Prize" – a prize for finding ways to combat ageing and restore vitality in mammals. That second part is important, of course: living for hundreds of years would be a dismal experience if it came with the frailty of extreme old age. Therefore, half of the prize money will go to a team that manages to restore the vitality of an ageing animal to match that of a younger specimen, while the rest is for extending its lifespan by at least 50%. The vitality contest closes next June; the longevity prize closes in 2018, so we'll have to wait to see if either can be won.

A venture with a more hands-on brief is the California Life Company – Calico for short. Founded in 2013, its work so far has included collaborations with multiple medical institutions exploring age-related diseases and cognitive decline. Its research staff comprises experts from the fields of medicine, drug development, molecular biology and genetics – including the above-mentioned Cynthia Kenyon, who holds the title of vice president of ageing research. There are plenty of other institutes working on similar projects, but Calico looks like an unusually good bet since it's exceptionally well funded – being, as it is, founded and backed by Google.



Those suffering incurable disease could one day be helped by cryonics



LEFT Dr de Grey is perhaps the best-known anti-ageing evangelist

Young again

One of the most prominent individuals in the fight against ageing is Dr Aubrey de Grey, a Cambridge-educated scientist and

author. Previously a software engineer at Sinclair Research, in 1999 de Grey published *The Mitochondrial Free Radical Theory of Ageing*. In it, he linked ageing with cells becoming damaged, failing to function as they should or accumulating "junk" molecules – and he believes that by combating these processes it ought to be possible to prolong life almost indefinitely.

Dr de Grey's hopes for anti-ageing research were set out in a 2005 TED Talk ([pcpro.link/251ted](https://www.pcpro.link/251ted)):

"If you're only 50, then there's a chance that you might be able to... start becoming biologically younger in a meaningful sense, in terms of your youthfulness, both physical and mental, and in terms of your risk of death from age-related causes. And of course, if you're a bit younger than that, then you're never really even going to get near to being fragile enough to die of age-related causes."

In 2009, de Grey co-founded the SENS (Strategies for Engineered Negligible Senescence) Foundation in the US, with the aim of promoting and bringing to reality "the repair of living cells and extracellular material in situ".

Cryonics

Technology that can restore our youth and cheat death won't come soon enough for everyone. Enter cryonics: the field of science that deals with freezing just-dead or dying humans, with a view to resuscitating and restoring them to health in the future.

By contrast with the cutting-edge work that's being done in genomic anti-ageing research, cryonics certainly isn't a new idea. It was popularised in 1962 in a book entitled *The Prospect of Immortality*, written by US academic Robert Ettinger. In 1967, psychology lecturer James Bedford became the first person to be frozen immediately after death with a view to future revival.

To date, no-one has yet attempted to revive a frozen person from a cryonic state; it's feared that the organs of older subjects may have been permanently damaged by the water in their bodies forming

crystals as it freezes. But, amazing as it sounds, the idea could work.

In 2005, researchers at the University of Pittsburgh managed to place dogs safely into suspended animation by draining their blood and replacing it with an ice-cold saline solution.

The dogs spent three hours in a state of clinical death with no heart or brain activity;

when the blood was returned, and the dogs' hearts were stimulated by electric shock, they returned to life, in most cases with no visible ill effects. In the future, the technique could be used for the victims of critical injuries, to buy time for treatment to be arranged. Or it could be used to freeze people with currently incurable diseases, until such time as a cure can be found.

If you're only 50, then there's a chance that you might be able to start becoming younger

Image: share conference.net

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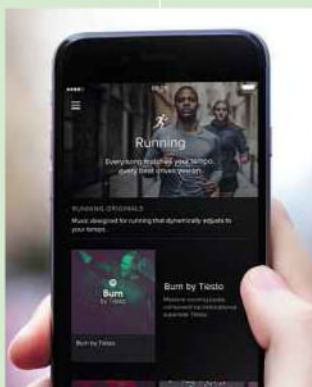


GET FIT

Fitness goals are easily quantifiable, whether you're shooting for 10,000 steps a day or 1,000 calories burnt. So if you're trying to get fit by running, swimming, riding a bike or playing sport, there's probably already a wearable device on the market to help. Is it worth the money? Well, an American study by the Brigham and Women's Hospital and the National Cancer Institute looked at the impact of exercise on more than half a million adults and found that those who took the recommended minimum of exercise lived on average three and a half years longer.

Running

Running pace is one of the easier things for modern gadgets to measure: ratty pedometers have been doing the same job (albeit less accurately) for years. You don't even need a dedicated device: a smartphone with MapMyRun (free; Android, BlackBerry & iOS) installed will chart where you go on your runs, how long it takes, your pace, and how many calories you burned doing it. Even apps that ostensibly have nothing to do with running are getting in on the act: an in-the-works update to Spotify's iPhone and Android apps will introduce a Running mode, with curated playlists and the ability to measure your speed and play appropriately paced music.



When it comes to dedicated hardware, there are plenty of options, although they aren't created equal. As we've noted before, the Microsoft Band's (£170) optical heart-rate monitor doesn't measure your pulse frequently or accurately enough to track a serious cardio session.

The Apple Watch (£299) generates more accurate results, and while it lacks the cross-platform appeal of the Microsoft Band, it also enjoys much broader app support: on the day of the Apple Watch's launch, RunKeeper was made available for the new platform, and with third-party native apps (apps that don't rely on an Apple Watch's host iPhone) due for release in autumn, the Watch is a strong contender with bags of potential.

What is the future of wearables for running? In a press release at the end of last year, Sony announced its SmartEyeglass Attach concept. Using a tiny OLED screen attached to a pair of sporty-looking glasses, the Attach gives you a real-time view of fitness data, gleaned either from onboard sensors or a Bluetooth-connected smartphone. For those interested in developing apps for the platform, the beta SED-E1 can be had for £624.

Cycling

Cycling technology is already big business, so the treasure trove of cycling gadgets comes as no surprise. Those looking simply to map their rides, and track speed and gradient information, can use the Strava (free; Android & iOS) app, which uses a smartphone to record the relevant data. Competitive types can then compare their stats with others' on Strava's website – turning a gentle Sunday morning ride around popular locations such as Richmond Park into gruelling tests of stamina against the personal bests of superior athletes.

Garmin has created an interesting cross-genre device in the VIRB Elite (£250 for the cycling bundle). A 1080p camera with built-in Wi-Fi and GPS, plus Bluetooth and compatibility with Garmin's ANT+ heart-rate monitors, the Elite allows



you to turn your rides into data-rich, audiovisual feasts. Or there's Recon's Jet – an Android-powered Google Glass-type affair with a tiny WQVGA display that, according to the company, is like looking at a 30in monitor from 7ft away. The display can keep cyclists up to date with things such as distance travelled and speed, while ANT+, Bluetooth and Wi-Fi all make appearances. It can pair with a phone to work as a hands-free kit, but because it's powered by a 1GHz ARM Cortex-A9 processor and has its own GPS unit, it doesn't need one to work. It comes preconfigured for popular exercise services such as Strava and MapMyFitness; cycling geeks will appreciate the ability to export raw data files into other applications.

Finally, there's a very real way technology could prove a life-saver. The ICEdot Crash Sensor (£96) is a small puck-style device that connects to a host smartphone (Android and iOS are supported) via Bluetooth. If the sensor's internal accelerometer detects a sufficiently violent blow, a countdown is triggered, at the end of which the host phone delivers an emergency text, including GPS co-ordinates, to a pre-entered number.

Football

Although overall fitness plays a big part in football, there's also a host of football-specific smart devices and wearables aimed at helping Sunday-league players hit peak form. Adidas is leading the charge with miCoach, a fitness-tracking system that includes running, football, tennis and general fitness via a host of gadgets such as the Speed_Cell (£55), a Bluetooth sensor that sits on your trainers and records up to eight hours of fitness activity. This can be synced to a smartphone (Android, iOS

and Windows Phone are all supported) and stored online. The website can then be used to measure your performance against other athletes, including – a mite depressingly for anyone who reckons they're half-decent – data gleaned from Argentinian legend Lionel Messi during a 2012 friendly against Germany. Adidas also makes the miCoach Smart Run, a £300 Apple Watch-alike that does a similar job to the



My week of fitness tracking



As someone who's worn the same watch for 13 years, I hated putting on the Microsoft Band. It's not comfortable, and it doesn't even show the time unless you tap a button.

But in a few days things started to click. After a photography workshop at Whipsnade Zoo, I was proud to find I'd taken 18,630 steps over a distance of 9.72 miles. After a second day, I found I'd burnt almost 5,000 calories.

Really, this data only underlined what I already know: walking burns calories and elevates your heart rate, while flopping on the sofa does neither. For now, though, I'll carry on wearing the Band: filling in each day's activity in the Dashboard software is quite addictive, and if it inspires me to keep active then so much the better. DAVE STEVENSON

Speed_Cell with the addition of a heart-rate monitor and a 1.45in, 184 x 184 display.

Finally, for the truly data-driven, there's the miCoach Smart Ball, a regulation football whose difference isn't just its steep £145 price. A triaxial accelerometer inside it records data such as speed, spin and precisely where the ball was hit, to help you improve strike technique. Data is fed back to an iPhone for later inspection.

Swimming

Combining technology with water is normally a recipe for disaster, but devices such as the Garmin Swim (£94) are turning the tide: this sports watch is

waterproof to 50m and capable of detecting which stroke is being used, along with a length counter and the ability to measure your stroke and pace.

Then there's its incoming rival: Swimmo, an aquatic smartwatch, launched on Kickstarter earlier this year aiming to raise a modest \$39,000 (around £25,500), but attracting more than \$184,000 (over £120,000) in pre-orders. The

first batch is set to be delivered to dedicated dippers in October 2015. Like the Garmin, it offers a length counter, with pace and distance tracking; unlike Garmin's offering, there's also a heart-rate monitor and a full-colour 1.29in screen. Its data is also compatible with apps including Strava, RunKeeper and, usefully for Apple users, HealthKit. Swimmo can be preloaded with workout goals, and an internal motor provides a vibration alert if you're falling behind or steaming ahead of where you want to be.

Golf

Golf has a reputation as an expensive sport, and golf-orientated GPS devices – handy for measuring the distance to the hole, and alerting you to hidden traps – have been around for some time. Lately, they've taken on a wearable dimension. TomTom's Golfer watch (£165) has a monochrome, 0.45in, 168 x 144 screen, and looks sufficiently like an Apple Watch to make us suspect a dedicated iOS app can't be far off.

Alternatively, the £130 Zepp Golf Sensor attaches to a glove and uses a pair of accelerometers and a three-axis gyroscope to provide its companion app (Android & iOS) with a 3D render of every swing, to help you study and improve your form.



Continued from p44

"The fastest-growing area for this is remote monitoring," said Price. "It's where people wear a bracelet that collects data and sends it back to a server, where it's monitored by a hospital or a patient's clinician. So, for example, if you have someone who's a diabetic, what's happening to their bloods is regularly fed back, so that doctors can change treatment levels if necessary."

While helping individual patients, the data can also be used – once suitably anonymised – for large-scale research. Collected together, the data from a large number of diabetes sufferers provide an overall picture of their habits and health.

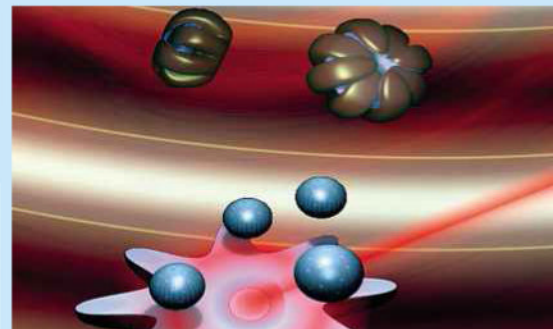
"Doctors like it, because it's increasing how much data they're seeing," said Price. "Instead of information about 20 people from their surgery, it's 200,000 all sharing – and the sharing is key to the medical community. It isn't in dribs and drabs; they're seeing what 200,000 diabetics are doing in the UK; there's a pool of information."

There's some way to go when it comes to data sharing. Currently, much of the information that's gathered is locked up in standalone smartphone apps, because the different software platforms don't yet talk to each other, and developers are understandably wary of sharing such valuable and sensitive data.

"If you think about the Apple Watch, and such products, it's easy to say 'this can be integrated with my health records, and the data can go straight to my GP and they can monitor my health'," said Silvia Piai, senior research manager for IDC Health Insights. "But there's a real question over the interoperability of the data, and how to integrate it with the systems used by the doctors. That's the difficult part. The huge benefit will come only if we can integrate better between the medical and the consumer side."

The issue isn't a showstopper, though. Tech companies, including Apple and Google, are positioning themselves to provide a platform for health professionals to use and create healthcare apps, and to enable them to talk with each other. For example, a heart-monitoring app could exchange data with a blood-pressure app to build a more detailed picture of any significant changes over time. And with a common platform, the information could be passed directly to a doctor if the data indicated a need for medical attention.

Already, Apple is talking to hospitals in the US about how its offerings can be integrated into current medical systems,



Bionic medicine

Today's emerging health technologies focus largely on healthy living outside of the doctors' surgery. But work is also underway in developing new in-hospital technologies that can transform treatments for illnesses and disabilities.

For example, the University of Leeds is working on a system to provide amputees with sensations from prosthetic limbs, by plugging sensors directly into the recipient's nervous system. "We can embed sensors in the fingers of the prosthetic hand, and those signals will be delivered wirelessly to the original nerve in your arm," said Dr Rory O'Connor, senior lecturer in rehabilitation medicine at Leeds.

"So when you're picking up an object, you won't know it's not your original hand touching the object. We're embedding sensors that are 40 microns in width, which can be put into the peripheral nerve and integrated into the body's own sensory system. The electrodes will go into the bundle of nerves for touch, temperature, vibration and sensation.

"There are lots of people living with damaged nerves from diabetes, and this would allow us to bridge the gap. It could be used anywhere in the body, from peripheral nerves to the spinal cord, if it's been severed." The researchers hope to develop a working prototype within three years.

Meanwhile, researchers at the Swiss Federal Institute of Technology in Zurich are working on nano-scale robots that will carry a medical payload through the bloodstream to deliver treatment directly to the affected area. The researchers have started tests for treating age-related eye disorders, but the concept could be used for more complicated treatments as it's developed over the next decade.

"If we can make tiny things that can move in intelligent ways, a good application would be small devices that carry drugs and target particular locations in the body," said project leader Professor Bradley Nelson.

"For example, we can deliver drugs to very specific locations in the retina. Over the next decade, I think we'll see devices that can do this – perhaps delivering stem cells to various locations to help treat things."

and Google looks likely to follow suit. How far the tech industry succeeds in establishing a common platform will determine more than anything else just how beneficial these tools can be, for both individual patients and human health in general. ●



click·bait

noun \kɪk- baɪt/ NEW

plural click-baits

: something (such as a headline) designed to make readers want to click on a hyperlink especially when the link leads to content of dubious value or interest

<it is difficult to remember a time when you could scroll through the social media outlet of your choice and not be bombarded with: You'll never believe what happened when ... This is the cutest thing ever ... This is the biggest mistake you can make ... Take this quiz to see which character you are on ... They are all classic clickbait models. And they are imitating as hell. There's no singular way to craft clickbait, but the essence is clear: Lure—no trick—readers to your site. — Emily Shire, *Daily Beast*, 14 July 2014>

<... 'clickbait,' those seductive Huffington Post-esque headlines that suck up your attention but don't deliver what they promise? — Oliver Burkeman, *The Guardian* (London), 10 Aug. 2013>

<... there's an incentive to combine clickbait, to get people in, with strong content to keep them on the site. — Steve Hind, interviewed on National Public Radio, 10 Nov. 2013>

First Known Use of CLICKBAIT

2010

emo·ji

noun ɪə- mɔ- jə/ NEW

plural emoji or emo-jis

: any of various small images, symbols, or icons used in text fields in electronic communication (as in text messages, e-mail, and social media) to express the emotional attitude of the writer, convey information succinctly, communicate a message playfully without using words, etc.

<The fingerless gloves keep hands warm and thumbs free. They're enough to make a texter rejoice (and maybe send an emoji expressing gratitude). — Jeannie Nuss, *Columbus (Ohio) Dispatch*, 22 Dec. 2014>

<The function of emoji, as [emoji developer Shigetaka] Kunita describes it—adding subtle emotional emphasis to a sentence in text—isn't too different from that of emoticons, the frowny and smiley faces that people have been making out of punctuation since the mid-1990s. — Britt Peterson, *Boston Globe*, 22 Sept. 2013>

<Think Moby Dick's text is too boring? So did Fred Benenson, a data engineer who translated the whole tome into emoji, the cutesy-symbol language popular on smart phones and comment pages. — *Time*, 11 Mar. 2013>

<White House officials channeled their inner teenager, typing a report that uses emoji to convey statistics about young people. The report dubbed '15 Economic Facts About Millennials' features dozens of text-message-centric icons, such as a bag of coins to indicate 'money' and a flexed muscle to convey the word 'strong.' — Natalie O'Neill, *New York Post*, 12 Oct. 2014>

— compare EMOTICON

Origin of EMOJI

borrowed from Japanese; literally, 'pictograph,' from e 'picture, drawing' + moji 'letter, character'

First Known Use: 1997

net neutrality

noun NEW

: the idea, principle, or requirement that Internet service providers should or must treat all Internet data as the same regardless of its kind, source, or destination

<... a philosophical contest that's being fought under the banner of 'net neutrality,' a slogan that inspires rhetorical devotion but eludes precise definition. Broadly, it means everything on the Internet should be equally accessible—that the Internet should be a place where great ideas compete on equal terms with big money. — Sarah Rabil, *Bloombergview.com*, 10 Nov. 2014>

<The agreement could eventually lead to higher charges for Internet users. Such an agreement could overthrow a once-sacred tenet of Internet policy known as net neutrality, in which no form of content is favored over another. In its place, consumers could soon see a new, tiered system, which, like cable television, imposes higher costs for premium levels of service. — Edward Wyatt, *New York Times*, 5 Aug. 2010>

<The FCC mandated that Comcast must observe net neutrality as a condition of its 2011 merger with NBCUniversal. — Tom Risen, *US News & World Report*, 12 Nov. 2014>

First Known Use of NET NEUTRALITY

2003

How tech is changing language

New ways of speaking, new ways of writing, new ways of emailing. **Nicole Kobie** asks whether our language can withstand the OMGs, LOLcats and smiley faces

The English language is totes changing, because internet. If that sentence makes you grit your teeth, it's probably best you don't spend too much time online. Like any community, the internet has developed its own vocabulary and slang – and while much of it is silly, from “LOL” to “OMG”, some of it has slipped into the mainstream. Selfie, anyone?

Is this invasion of new words destroying the English language, or is it no more than a next step in a continual evolution. Here's what the experts say.

Ermahgerd! English?

Professor David Crystal is a leading researcher in online linguistics – he literally wrote the book on the subject, and is seen as the originator of the academic field. We asked him if the web is ruining English: “No,” he said. “No, is the short answer.”

The web is hardly the first technological innovation to impact English, he pointed out. The advent of broadcast television led to similar concerns, but Crystal said the actual shift in language from that technological revolution was “really very small”.

This is true of the internet and other modern technology. “If you make a list of the bits of internet slang that have crossed

the divide, we're talking about just a handful – you know, LOL, that sort of thing,” he said. Back in 2004, Crystal tried to count such words, building a glossary of “netspeak”, “textspeak” and other tech terms that were being used in mainstream discourse. “I remember spending a very boring week trying to count all the new words and sentences that had come about in the previous ten years because of the internet,” he said. “I ended up with a total of about 1,000, or maybe 1,500.” If he repeated the word count today, he reckons that figure would top 5,000, especially if variations such as “Twitterverse” and “Twittersphere” were included.

This may sound a considerable tally, but Crystal pointed out that English already has “heaven knows how many million” words, and with this genre we'll see a few more. And this is why it's “nonsense” to say the internet has caused a deterioration in the English language, because the impact on vocabulary has actually been tiny.

Grammar is changing, because internet

The internet's impact on English is even smaller on grammar than vocabulary, despite the outcry surrounding the evolution of “because” into a preposition, Crystal said.

You're likely to have seen that sentence construction in headlines or social media posts. As linguistics blogger Stan Carey notes: “‘Because’ has become a preposition, because grammar.”

The use of “because” in this manner isn't new, however, said Crystal. “It's been in the language for hundreds of years. It's a fashion. It's always happened to grammar – certain things become fashionable and are very widely used for a time, and then they go out of fashion again. It's not a novel construction in any way, or a novel usage,” he added.

“A typical example of a construction that nobody had noticed before, and then suddenly everybody was using, is ‘Yes we can’ from Obama. Suddenly, for a few years everybody was saying, ‘Yes we can’ or ‘No we can't.’ It became a bit of a meme.”

IDK, check the OED

There are many examples of web slang slipping into our everyday conversations, but a word hasn't officially made it into our language until it's been included in the Oxford English Dictionary (OED) – and that's not easy for words to do, said Denny Hilton, senior assistant editor at the dictionary. “For inclusion in the OED, we're really looking for sufficient evidence

LOLWTF S2GT



TOTESLURKERS JOENOSSELF

that they're established items [of] vocabulary in English," he explained. "We're looking for evidence from a variety of sources, for a reasonable amount of time, to indicate that they're actually in established usage and worth being included in the dictionary."

Many technical words stem from the early computing days of the 1960s and 1970s, and Hilton said the OED team examines the archives of Usenet forums from that era to uncover origins of words. "User-friendly" is a clear example of a word that started out specifically in the realm of computers in the early 1970s and transferred to mainstream use, developing the more general extended sense 'accessible, manageable', he said. Increasingly, however, the origin of tech words is likely to be social

media such as Twitter.

While other dictionaries add such words more quickly, the OED avoids including terms too early, because it's difficult to determine which of them will remain in use.

"You'll have this sort of flurry of linguistic activity and lots of invented vocabulary, and you get people playing with vocabulary and turning nouns into verbs, and adding linguistic suffixes, and inventing new ways of using the language," he said. "Then, after a certain period of time it all settles down. The words are useful if they fulfil some kind of semantic purpose. In this case they'll survive; they'll have longevity."

Hilton believes that with a lot of the emergent internet vocabulary we're seeing right now, we're in that initial period of activity.

TTFN, abbreviations

Language evolves without every word being included in official dictionaries – indeed, the best source for looking up an odd term online isn't the OED but the Urban Dictionary. Such slang isn't limited to the internet of course, but many of us are more likely to come across words on the web than those verbally traded by teens.

And it is because of this that shortened phrases ("totes" from totally, "amaze" from amazing), as well as abbreviations such as LOL, deteriorations such as from OMG to Ermahgerd, and entirely new words such as "derp" make their way into our speech, as well as our dictionaries.

"Slang is limited to specific groups, even if they're large ones such as regular web users," said Crystal. "It's an identity thing for that particular group. No general dictionary will include a word just because it's got some slang use by a group of nerds in California."

As ever, such slang is more likely to be used by younger crowds, confounding older generations. Crystal said the best example of that is texting abbreviations – the L8Rs (laters) and so on. As such constructions have become more mainstream, they've fallen out of favour with younger people. He recounts a visit to a school where he collected examples of text messages to analyse and was surprised by what he found. "There wasn't a single abbreviation to be seen. You know, not a single LOL, not a single CU Later, or anything," he said.

He asked the teenagers what happened. "We don't do that any more. It's not cool," he revealed. "And one lad said to me – and this is the most illuminating point of all – 'I'll tell you when I stopped abbreviating... when my dad started'."



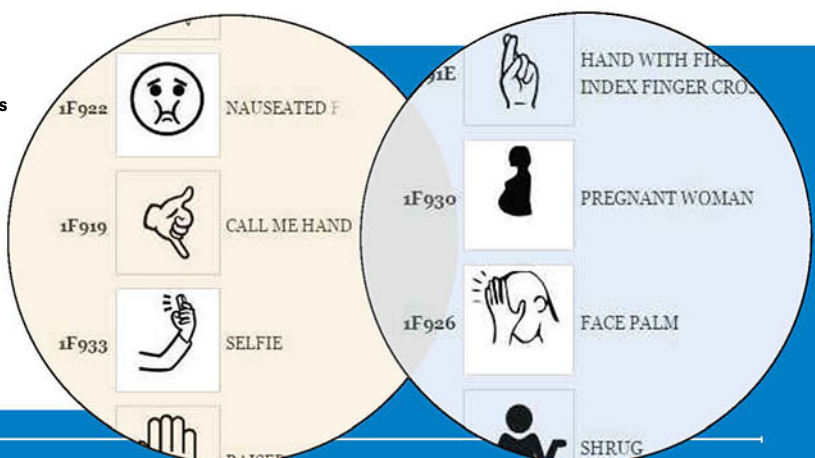
Normally, that would take at least a decade of evidence, but Hilton admitted that the fast pace of technological change means "we're actually including some words a bit sooner than we might have done in the past, because their use is so obviously widespread".

Some words to have made the cut are clearly new – recently, "hashtag", "retweet" and "selfie" have all been added to the OED – but other words we assume are modern actually predate the web. For example, many of us believe OMG – an abbreviation of "oh my God" – came about via texting teenagers, but its first recorded use was back in 1917. "It was a one-off at the time, but it isn't unusual to find that a lot of these terms go back further than you might expect," Hilton said. Even LOL – laughing out loud – goes back to 1989, and was also used as an abbreviation for "little old lady" back in the 1960s.

EVOLUTION OF EMOJI

Emoji this year finally got diversity, with the Unicode Consortium behind the icons approving images of a variety of races. However, many concepts remain outside the emoji circle – there's still no way to use emoji for pregnancy, in case that's how you wish to share the news of a looming bundle of joy.

Next year, the standard is set for another update with the addition of emoji for a pregnant woman, a dancing man (to accompany salsa-dancing lady), a "face palm" to show frustration, and food (croissants, cucumbers and bacon). There are also plans to include a nauseated face (handy for hangovers), a hand taking a selfie (of course), and an avocado. Because sometimes the word itself just simply isn't enough to describe the idea of avocado. Check out prospective candidates at pcpro.link/251pcpemoji.



I CAN HAZ NEW LANGUAGE?

The web isn't only responsible for new words, it's led to entire new languages – silly though they may be. This being the feline-friendly net, one of the best is based around cats.

LOLcat is a degraded version of English that's deliberately incorrect in terms of spelling and grammar. It stems from a now-famous image of a cat captioned with "I can has cheezburger?", evolving into website, a meme of pictures of cats, and the speech itself, which is sometimes called lolpeak or "kitty pidgin". Or, in the language itself, via the LOLcat translator at speaklolcat.com:

IT STEMS FROM A NOW FAMOUS IMAGE OF A CAT CAPTIONED WITH "I CAN HAZ CHEEZBURGER?", AN EVOLVED INTO WEBSITE, MEME OF PICTUREZ OF KATS, ANTEH SPEECH ITSELF, WHICH IS SOMETIMES CALLED LOLSPEAK OR "KITTEHPIDGIN".

It works better with shorter sentences. If you're not a cat lover, don't worry, there's a dog-based alternative called Doge, which involves heavy use of the word "wow" and "very", a picture of a Shiba Inu dog, and the Comic Sans font. Yes, the internet is an odd place indeed.



Thumbs up for emoji

Abbreviations may be dying, but multiple reports suggest a growth in the use of emoji, the small pictures you can embed in messages to show you're happy, sad, or a dancing lady in red. Research by Instagram revealed that 40% of comments on the photography app feature emoji, and earlier this year, Australian foreign affairs minister Julie Bishop even responded to a BuzzFeed interview using the icons (pcpro.link/251emoji).

Vyvyan Evans, a professor of linguistics at Bangor University, examined emoji usage for a TalkTalk report, finding that 80% of 2,000 Brits polled said they regularly use emoji, with 40% saying they've sent messages entirely using the icons. As before, the shift to pictures has been fastest among

Evans suggested that emoji can help "punctuate" a sentence. Body language, intonation, sentence pace and other verbal queues can all help suggest meaning, Evans pointed out, and all are missing from the written word. "Communication... doesn't just require language, which is basically a system of meaningful symbols and a syntax of grammar that combine them together," he said. "It requires these other features as well. And that's what emoji is doing in digital communication – it's enabling people to add additional meaning [that's] not coming through necessarily from the text."

If you've ever suffered from a colleague interpreting your email not as intended then you'll see the value in appending a cheerful face to a sentence to make your meaning clear. Indeed, Evans believes emojis have already started to sneak into business emails, following their simpler predecessor the emoticon, combining punctuation symbols to make expressive faces. "I suspect that the increased use of emoji will come in a sort of

Perhaps the best example of that divide comes from Christopher Poole, best known as the founder of messaging board 4chan. Back in 2010, he was asked to explain some terminology during the trial of a man accused of hacking the email account of former US politician Sarah Palin. The court asked him to define "Rickrolling" – tricking someone into clicking a link leading to a video of Rick Astley's "Never Give You Up" – as well as "lurker", "troll" and some other terms not suitable for a family magazine.

That the judges and barristers weren't aware about Rickrolling may well be amusing to those of us long tired of the joke, but it doesn't mean the structure or vocabulary that is the English language is in danger. It's so flexible you can't hurt it, no matter how many LOLs, derps or icons of Japanese food you throw at it.

Indeed, Crystal suggested that the silly terms Poole was asked to explain may not be a sign of degradation of English, but of creative language skills. "I love the language play that comes up," he said, pointing to Twitter-inspired slang. "That 'tw' consonant cluster at the beginning of the word is a very unusual consonant cluster for English. I mean, if you look it up in the dictionary, you don't find many words beginning with 'tw'. And so, it was ready for exploitation... [and we've] generated a huge number of playful expressions."

He said words such as "twictionary", "twitterholic", and even "twitterhoea" show "how the human propensity for language play is alive and well".

So OMG, maybe the internet is good for English, because imagination. 😊

NSFW abbreviation

not safe for work; not suitable for work — used to warn someone that a website, e-mail attachment, etc., is not suitable for viewing at most places of employment

<Sure, you can let employees use company PCs for non-work Web browsing, but you don't have to let them visit NSFW sites. — Neil J. Rubenking, PCMag.com, 21 Jan. 2014>

— compare SFW

younger people, with Evans saying his research found that 31% of people over the age of 40 don't use the icons, and more than half aren't clear what most of them even mean. "There's a definite age split," he said.

Indeed, three-quarters of those between the ages of 19 and 25 said that "it's easier to express emotions through emoji rather than text," Evans said, adding that many of the age group believe that "using emojis in conventional text can improve their ability to interact".

standard email context where they weren't before," he said, pointing out the rise of devices such as smartphones and tablets, which include emoji in their keyboards.

Playful twenglish

You may not understand every word you read online or every emoji in text messages, but then you're not supposed to – all that slang is designed to make communities mesh, and that necessarily means that everyone else is left out.

YABAROFILM
RICKROLLING



GOING PRO: RIP-OFF *or* THE SENSIBLE CHOICE?

It's oh-so-tempting to opt for free software when running a small or single-person business, but are the "pro" software and services worth their premium? **Barry Collins** investigates



Walk into any British Airways business lounge and you're unlikely to find seats occupied by the self-employed. Instead, they'll be filled by the employees of large corporates, running up the bill on the company credit card. So why should sole traders and freelancers go to the expense of business class when it comes to software or services?

Certainly, the companies do everything to warn you away from "consumer-grade" products. Everything from Windows to antivirus, from broadband to webmail, adds a premium for "pro" or "business" versions that vendors tell business owners they're foolish not to buy.

If they can't convince customers to pay for the business-related extras through choice, they'll try to bully them through dubious licensing conditions. That copy of Office 365 Personal you bought for your home laptop? The Ts&Cs say you shouldn't be using it, for anything work-related, even just working from home for a day. Same goes for the PowerPoint iPad app you downloaded from the App Store.

Yet, if you're prepared to risk the infinitesimal chance that you'll be prosecuted for using the wrong version of Office, is there any good reason to pay for premium business software? Does a business broadband connection really offer greater peace of mind, or is it just the same wire with a £15-per-month surcharge?

We've been talking to the companies selling these premium services to find out if there's anything that can justify the cost.

Paying for pro

Microsoft recently confirmed that Windows 10 will follow the pattern of every release since XP, with a Pro edition to accompany the Home versions of its operating system. What's the difference between the two? Zero, at least in terms of the codebase. But Microsoft locks some potentially business-critical features in the Pro version to ensure it gets a pound more flesh from professional users and corporates.

The good news: few of these features are of much use to homeworkers or micro-businesses. You'll need Pro to join a domain, unlock some network-management features and take advantage of BitLocker encryption, but most small-business owners can live without those.

BELOW The time you're most likely to appreciate a business broadband package is when something goes wrong, with faults repaired within a working day

However, it most certainly does pose a problem for those planning to take their own devices to work. As Microsoft's own literature states: "If you allow users to connect their BYOD devices running Windows 8.1 to your network, your organisation probably requires them to join the domain. Domain Join requires Windows 8.1 Pro or Windows 8.1 Enterprise." Few consumer laptops are sold with Pro versions of Windows, meaning companies will either need to foot the bill for Pro Pack upgrades (around £100) or have no control over the BYOD devices on their network.

The situation is even murkier when it comes to Microsoft's other software cash cow: Office. Again, there are home and more expensive business subscriptions for Office 365. A freelancer working from home

activities," state the software licence terms for the Home, University and Personal editions of Office 365. By the letter of the licence agreement, you can't even bring work home from the office. Someone really needs to inform Microsoft's own support staff. We asked the online chat facility on the Office 365 subscriptions page if we could "use Office 365 Personal for working from home" and the advisor replied: "Yes, that is possible". Possible, but frowned upon.

It's not only the full-blown PC apps that aren't meant to be used for business purposes; the same goes for the Office iPad apps. The blurb on Word's App Store entry promises you can "pick up where you left off" and "rest assured that you don't lose your work while you're on the go", but click on the licence agreement



Does a business broadband connection offer greater peace of mind, or is it just the same wire with a £15-per-month surcharge?

might be attracted by the Office 365 Home package, for example, which allows them to install all of the key Office applications (including Outlook) on up to five PCs. They might even get away with the Office 365 Personal tariff, which gives a single installation for only £6 per month.

Yet delve into the terms and conditions and you'll find that this isn't allowed. "The service/software may not be used for commercial, non-profit, or revenue-generating

and you're told that your usage rights permit you to "create, edit or save documents for non-commercial purposes". Even if you've signed in with an Enterprise subscription!

Does Microsoft have any hope of enforcing such conditions? Is there anything to stop homeworkers or micro-businesses from working with Office 365's Home packages, which have all the features that most professional users would need? We spoke to Julian Heathcote Hobbins, general counsel at the Federation Against Software Theft (FAST), of which Microsoft is one of the most prominent members. Hobbins said he hadn't specifically studied the licensing terms on Windows and Office products, but "if you pay for something, you ought to play by the rules".



However, he conceded that anti-piracy organisations such as FAST are predominantly concerned with commercial pirates and companies that are running numerous instances of a single licence, not picking on paying customers who might be breaching a technicality in the licence agreement. "My hunch is a big, well-known household name isn't going to crack down on its customers," Hobbins said, adding that he hadn't been instructed by any of his clients to take action against customers who've used home licences for professional purposes.

A Microsoft spokesperson told *PC Pro* that the company "advises sole traders/small-business owners to use the Office 365 business plans because they're specifically designed for professional use, and are simply a better fit for businesses". The company also reiterated that the Home and Personal Office 365 subscriptions were only "licensed for personal use" and that "by signing up for a plan, each customer is agreeing to the terms and conditions of that plan".

It's not only Microsoft that uses its terms and conditions to freeze out businesses. Security software vendors often state in their EULAs that their product is not to be used for commercial purposes, but the owner

of an online software store – who asked not to be named – told us that vendors don't care about micro-businesses using home products for work. "If you have a small business or a home office, you're more than welcome to use off-the-shelf security software, as an example, on a PC you use for business," he told us. "I have

What about your webmail?

It's fairly common to pass plumbers' vans and see business ads with Gmail contact addresses. What's Google's take on consumer services being used for work? "If you are using our Services on behalf of a business, that business accepts these terms," Google's general service terms state, before going on to waive any "liability or expense arising from claims, losses, damages, suits, judgments, litigation costs and attorneys' fees".



In other words, do what you like, but don't blame us if you lose business because your webmail goes down. And although Gmail for Work offers professional features such as using your own domain, Exchange migration and 99.9% guaranteed uptime, the maximum compensation you can get from Google if your paid-for business email does go down for prolonged periods (more than 5% of the month) is 15 days' credit.

Security software vendors often state in their EULAs that their product is not to be used for commercial purposes

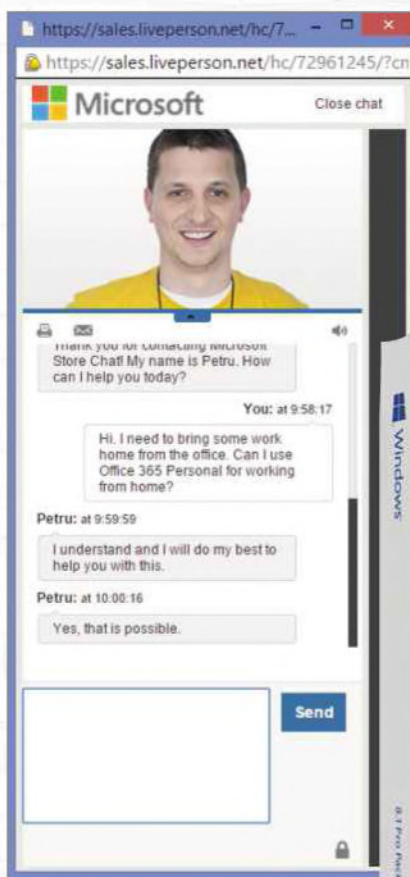
We can find nothing in Adobe's sprawling EULA for these packages that overtly bans business use, but there is a worrying clause for business owners that, once a year at a week's notice, gives Adobe the right to "inspect customer's records, systems, and facilities to verify that its installation and use of any and all Adobe software or service is in conformity with its valid licences from Adobe".

Broadband bills

It's not only for software that business users are expected to pay over the odds, but for services too. Choose BT's consumer-grade 76Mbps/sec fibre connection and you'll pay £26 per month inc VAT (prices correct at the time of writing). What's more, the BT Sport channels, weekend calls and a £100 prepaid Visa card are thrown into the deal, all of which may prove attractive to freelancers working from home. Jump over to the business side of the fence, and that same 76Mbps/sec connection starts from £40 per month exc VAT, or £48 inclusive. What are you paying almost twice the price for?

The raw connection will be exactly the same whether you opt for a consumer or business variant. BT and other business ISPs prioritise traffic for business customers at peak times, but with a 76Mbps/sec download and 19Mbps/sec up, your cabinet would have to be spectacularly busy for contention to be an issue for the vast majority of business tasks.

That said, prioritisation could be genuinely beneficial for those still stuck in ADSL-only areas. "We code or identify packets of data from business customers," says Nick Rawlings, commercial director of BT Business. "At times of high usage on our network, that's useful. You get the maximum speed that line is able to deliver at any one time."



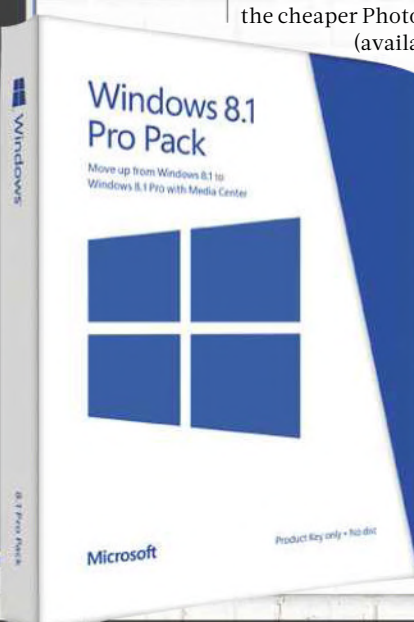
LEFT Can you use Office 365 Personal to edit work documents? Chat assistant says yes, licence says no

BELOW Windows' "pro" features cost an extra £100

four people who work for me, only one in this office. On his computer, I've installed my own admin login and Kaspersky Internet Security, which also works on his user account. This is fine under the EULA, as I own and control this computer and it's within the three-PC licence agreement."

Similarly, some small-business owners might be tempted to go for the cheaper Photoshop Elements (available for as little as

£50 online) rather than full-blown Photoshop (£8.57 per month), if they're only looking to do the occasional piece of photo retouching, not least because the Expert tab contains many of the same features as its professional-grade sibling. Ditto Premiere Elements for video editing.



BT does throw in a few extras with the business connections, too. All business tariffs come with a static IP address, which could prove critical for anyone needing remote desktop software and a VPN connection (or for that increasingly rare breed of person who wants to host their own email or web servers). Premium fibre connections also come with one Office 365 Small Business subscription.

BT insists the big difference – the one that really makes that £264 extra a year worthwhile – is the level of support. “The standard service on business lines is next working day,” said Rawlings, explaining BT’s fault-repair times. “On consumer lines, it’s the next working day plus one.”

Dedicated business ISP Spitfire agrees that avoiding call-centre hell is a very good reason for homeworkers to shun consumer broadband packages. Spitfire customers are assigned a member of the company’s support staff when they first ring in with a problem, who will attempt to see that problem through to its conclusion. The company’s sales director, Tom Fellowes, claims more than 80% of support calls are resolved by the first person a customer speaks to, rather than being pinged from one assistant to another, as can happen in consumer call centres. That can actually speed repairs, explained Fellowes, even though line faults are handled by BT.

“Standard repair time for any BT Wholesale line is 40 clock hours,” he said. “BT stops the clock and passes it back to its client, the service provider, to carry out things. So if they ask [end] customers to do a reboot, BT will stop the clock. If you’re dealing with a business provider, that message will pass straight through [to the customer]. If you’re dealing with a consumer ISP, how long will it take for that message to get through? Will you get it in a call? Will they try to send it via email, even though your email is possibly down? Rather than taking one hour to get that 20-minute reboot done, it could take overnight, half a day, a day.”

What’s more, Spitfire and other business ISPs can offer 20-hour or

even seven-hour repair times, at additional cost, which simply aren’t available on consumer tariffs. “If you’re a small business and this is your livelihood, that can make a big difference,” Fellowes pointed out.

How likely is it that your broadband will go down for a sustained period of time? BT doesn’t disclose figures for the uptime of its network, but figures published by Openreach show it takes an average of 2.67 days to fix the most severe faults, with minor problems taking an average of 1.79. Could you survive a couple of days without broadband, especially if you have a 3G/4G data connection as backup? That’s the £264 question in BT’s case.

Even BT admits that most sole traders won’t pay that price – at least, not initially. “A lot of small businesses, when they first start and work out of a home office, commonly begin with a consumer connection,” said Rawlings. “As that business grows, generally there’s an event in their life that causes them to reconsider their priorities, and the clearest probable event is going from zero employees to one employee. They then start choosing business broadband.”

Proceed at your own risk

Ultimately, running consumer software or services instead of business variants comes down to your appetite for risk. The cheaper Home versions of Windows, Office or security suites will contain all the features most sole traders or micro-businesses need, and the chances of vendors such as Microsoft sending round the licensing cops seems remote, bordering on non-existent.

When it comes to services such as broadband and webmail (see *What about your webmail?*, p58) the risks are more tangible. Could you afford to wait the extra day for your connection to be fixed? Is it essential you get the maximum possible speed from your line? Or does that free subscription to BT Sport and the couple of hundred quid you’ll save mean more to your business and family? Despite what the ISPs may argue, there are no right or wrong answers. ●

Avoiding call-centre hell is a very good reason for homeworkers to shun consumer broadband packages

Five ways pros can save money on software

1 Take a free trial

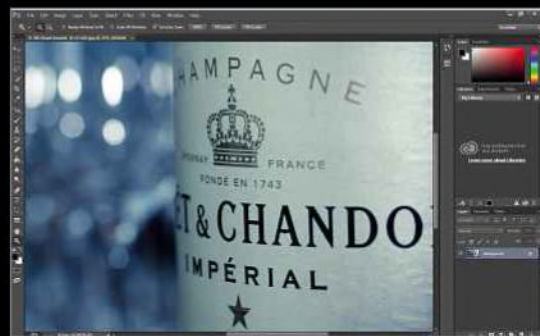
Free trials are great if you only need an application for a short period of time. For instance, Adobe offers 30-day free trials of any of its Creative Suite applications, so you can benefit from the power of Photoshop or others without handing over credit-card details.

2 Buy an old version from which to upgrade

Many professional software packages offer substantial discounts to upgraders. If you can pick up an earlier version from eBay or elsewhere, you can benefit from the upgrade price. There’s an element of risk here: you need to ensure the licence hasn’t already been used for an upgrade. Ideally, buy unopened older versions rather than second-hand.

3 Try a beta app

Anyone who says you can run a business entirely on beta software is talking out of their USB port. A mission-critical system isn’t the place to test Windows 10 or Office 2016. However, if there’s a specific, limited function you need, a beta product may give it to you for free. Betabound (betabound.com) rounds up current betas, which at the time of writing included video converters, a service allowing content owners to spot copyright infringements and other business apps. You might just find a freebie that does a job you need.



4 Take academic pricing

This one falls under “iffy, but very unlikely to get your collar felt”. Many software vendors offer sizeable discounts to students and teachers. Adobe, for instance, offers 65% off Creative Cloud subscriptions, bringing the price down from £45.73 to £15.49 per month. If you’ve got a teacher or student in the house and you work from home, you’re quids in.

5 Use referral codes

Some professional packages offer a discount or extra features for encouraging others to join. Accountancy software provider FreeAgent offers a 10% discount for the lifetime of your subscription for every new subscriber you refer – refer ten and it’s free! Online backup service Livedrive gives you three months’ free service for every referral, and many others do likewise.



Reviews



The biggest, best, most exciting products in tech – tested, evaluated and reviewed



Windows 10

Following nine months of public testing, Windows 10 is ready for prime time. Has Microsoft's experiment paid off?

SCORE ★★★★★

PRICE Upgrade from Windows 7 SP1 and 8.1, free; Home, £99 inc VAT; Pro, TBC

If ever an operating system has grown up in public, it's Windows 10. Since the first preview release appeared last October, its every tweak and transformation has been pored over by hordes of volunteer testers – almost five million of them, according to Microsoft's own stats on its Windows Insider

Programme, feeding back usage reports and feature requests.

But on 29 July, Windows 10 makes its real debut. On that date, retailers will be selling PCs with Windows 10 preinstalled, and users of Windows 7 and 8 who have claimed their upgrades – more about this later – will be able to move up to the final release of the software.

Except that in the case of Windows 10, there's no such thing as a final release. The new version of Windows brings a new philosophy, which Microsoft calls "Windows as a



service". Just as the Insider builds have progressively introduced new features and interface elements, the public release of Windows 10 will continue to develop over time. There won't ever be a Windows 11 – major features that would previously have been saved up for a major release will now trickle out through Windows Update as they become ready.

This makes Windows 10 very much a moving target – a platform that might work in one way when you install it, but turn into something quite different in a year's time.

For businesses, Microsoft is providing options to keep things stable (see *Windows 10 for business*, p63), but for consumers running the Home edition of Windows 10, Microsoft has taken the bold decision to disallow the skipping or deferring of updates. Like it or not, upgrading means taking an open-ended leap of faith.

So it's time to take a proper look at what's coming on 29 July, and give a verdict on the upgrade that will be most people's first taste of Windows 10. Although the final code hasn't yet been signed off, we spoke to UK Windows boss Robert Epstein who confirmed that, with the launch in sight, the latest Insider build reflects the user experience day-one upgraders will see. "There might be a few icon tweaks, but now it's all about polishing," he revealed.

■ Why Windows 10?

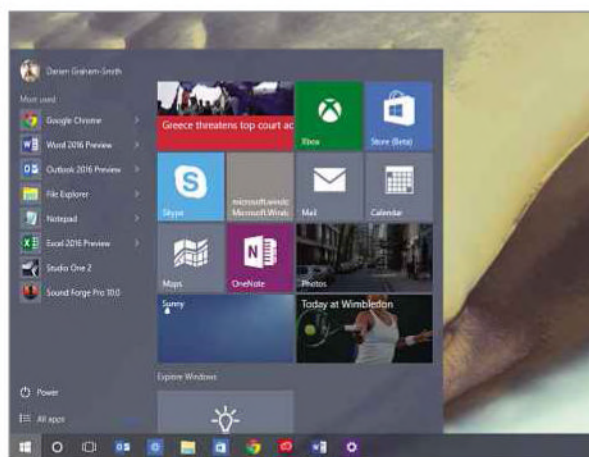
To be clear, the product that's being released on 29 July is a new operating system for your PC. Like previous versions of Windows, it's offered in both 32-bit and 64-bit variants, and in Home and Pro editions, alongside packages for education, enterprise and industry.

But Windows 10 is about more than a single piece of software. It represents the transformation of Microsoft's business, from a PC software company with a smartphone division into a grand unified platform, spanning from mobile devices to servers. Soon it will also take in consumer devices such as wearables and the Xbox One, as well as interesting one-offs such as the Surface Hub – a whiteboard-sized conferencing system and display – and the HoloLens, Microsoft's forthcoming augmented-reality headset.

It's all underpinned by the idea of Universal apps – touch-friendly, mobile-style applications that will run on a Windows 10 device. Fundamentally, it's an evolution of the Windows 8 concept, but we've come a long way since then.

The old Metro app platform (latterly renamed Modern) was clunky and ill-suited to desktop and laptop PCs. It made more sense on tablets, but here Microsoft was pushing Windows RT, and consumers were reluctant to buy in. They were wise to stay away: the platform has proved an evolutionary dead end, incapable of being upgraded to Windows 10.

Windows Phone, meanwhile, despite sharing design cues with Metro, was a different platform with a separate app framework. No wonder the Windows Store was initially a bomb, setting back Microsoft's dreams of emulating Apple's success in the emerging tablet-friendly world.



ABOVE The Start menu returns, now with added Live Tiles

Universal apps make the idea work at last. In Windows 10, it's possible to open a Universal app in a window on your desktop PC, then grab an Atom-powered Windows 10 tablet and carry on working with the selfsame app – in full-screen mode with touch controls. It will even be possible to run the same software on your Lumia phone once the Windows 10 Mobile update arrives – although that won't be until later this year, or perhaps even early 2016.

And we're not just talking about games here. Microsoft has already unveiled Universal ports of the Office apps, and it's making a strong case for businesses to adopt the platform for internal projects (see *overleaf*).

How this plays out in the real world depends on third-party support, of course, which has so far been the Achilles heel of the Windows Store. But the proposition will be far more attractive to developers than it was when the Store launched three years ago. Thanks to Microsoft's generous upgrade terms, Windows 10 will be a huge market, with the company aiming for one billion installations by 2017. In short, this time, Microsoft has got the ingredients right.

"Thanks to the upgrade terms, Windows 10 will be a huge market, with the company aiming for one billion installations by 2017"

BELOW In tablet mode, the full-screen Start interface echoes Windows 8



■ What's new in Windows 10

Windows 10's "new" features are already familiar thanks to the multitude of preview builds. The headline, of course, is the new Start menu. Not just a reinstatement of the old Windows 7 orb, this now offers Live Tiles with at-a-glance updates from Modern apps such as News, Mail and Calendar. By default it's a rather generous size, taking up at least a quarter of a Full HD screen, but you can resize it both horizontally and vertically, and if your tiles don't all fit, you can scroll to view them. On touch hardware, the Start menu opens in a full-screen view reminiscent of the old Windows 8 Start screen.

Start typing to search for an application or item and you'll meet the second major innovation in Windows 10. Cortana, the smart personal assistant introduced in Windows Phone, is now the default search agent for Windows 10, and can be invoked from the Windows key or with a three-fingered tap on your touchpad. The system finds programs and documents as before, but can also respond to other types of request: type in a calculation or a phrase such as "weather Sheffield" and results will pop up directly from your taskbar. It's a clever way

of dissuading people from going to Google for simple errands, but not yet smart enough: after a few requests such as "show me bus times" yielded only dumb Bing searches, I found myself falling back on the browser.

Interestingly, Cortana keeps the speech-recognition capabilities of its original smartphone incarnation. If you choose to enable your device's microphone, you can simply declare "Hey Cortana", followed by your request. As well as carrying out searches, you can perform simple



ABOVE The Action Center combines notifications and quick-access settings



LEFT Cortana information opens in a side pane within the Edge browser

actions such as setting a reminder, checking your calendar or opening applications. It's certainly a plus for tablets that lack a physical keyboard.

The third big feature in Windows 10 is Microsoft's all-new web browser, codenamed Project Spartan and now called Edge. After 20 years of service, Internet Explorer has been deprecated in favour of something much simpler and slicker. Some might say Edge is too simple, since there's currently no

support for plugins (a planned update later in the year should add this). Otherwise, it's responsive and easy to use, and because it's a Universal app there'll be no culture shock if you move between devices.

Edge even introduces a few interesting items, including an annotation feature that lets you scribble with a stylus onto a web page, or type into sticky notes, and save or share your markup

"Microsoft no longer wants to be held back by the inertia of huge numbers of customers using old versions of Windows"

for future reference – and across Windows 10 devices. There's Cortana integration too. Visit a restaurant's website and you'll see a Cortana prompt in the address bar: "I've got directions, hours and more." Click and the details appear in a pop-up pane at the side of the window.

Those major updates sit alongside a range of smaller tweaks. One simple but very likeable new feature is Snap Assist. It's an upgrade to the old Aero Snap feature in Windows 7, which let you dock windows to the sides of the screen by dragging or pressing the Windows key plus the left or right cursor. In Windows 10, when you snap a window into half-screen view, you're presented with thumbnails of other open windows: a click expands one to fill the other half of the screen.

Nobody at PC Pro is so keen on the interface revamp that turns all title bars either white or grey – it creates a dull appearance that makes it harder to see at a glance which window is active (see *10 great new features in Windows 10*, p64).

■ Worth the upgrade?

In previous years, most of us only moved to new editions of Windows when we bought a new PC. With Windows 10, Microsoft aims to change that. If you're currently running a non-enterprise edition of Windows 7 or 8, you may already have seen a pop-up notification on your desktop inviting you to "reserve" your upgrade to Windows 10.

For once, there's no catch. As Microsoft moves to "Windows as a service", it no longer wants to be held

back by the inertia of huge numbers of customers using old versions of Windows. So for the first year of Windows 10's availability, Windows 7 and 8 users are entitled to a free in-place upgrade.

It's worth noting that the upgrade requires you to be using a fully up-to-date release of Windows 7 SP1 or Windows 8.1, so if you're not getting the pop-up, try running Windows Update. Those using compact tablets may also find they don't have enough storage for an in-place upgrade: Microsoft says it's working on a solution, which will probably involve a USB flash drive.

The upgrade process is almost entirely automatic, and keeps your existing applications, so it's an easy offer to accept. If you're running a professional edition of Windows 7 or 8 you'll be moved up to Windows 10 Pro, otherwise you'll receive the Home edition (see *Windows 10 for business*, opposite, for a rundown of the differences).

Jon Honeyball's 5 reasons to upgrade

1 Latest design of underlying kernel
The Windows 10 core is literally years ahead of previous editions: don't you want to take advantage of the latest in performance and security?

2 Return of the desktop
Windows 8 was designed for tablets, and ignored the needs of the rest of us. Now it's time to get some work done.

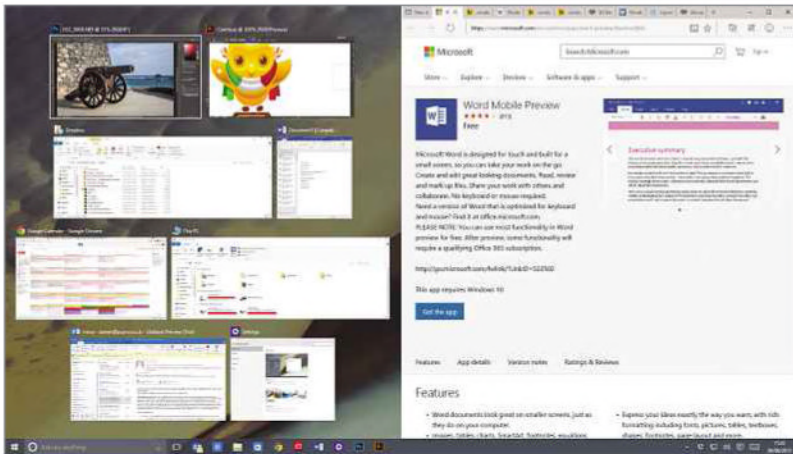
3 Latest specs in power management
Battery life is a huge issue for mobile devices – and businesses running banks

of workstations don't want to waste energy either.

4 Longest support window
If Microsoft is true to its word, Windows 10 Pro comes with perpetual support. Where else can you get such a deal?

5 It's not Vista or Windows 8...
Historically, Microsoft gets some things very right, and others decidedly wrong. Let's rejoice that Windows 10 falls firmly into the former camp.



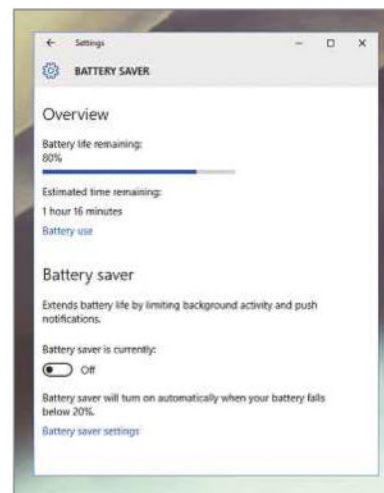


LEFT Snap Assist makes it easy to work with two documents side by side

+ The best Windows yet, for both traditional and touch hardware; opens the door to a new way of working with apps

— A new approach to updates means user experience could change

BELOW The new Battery Saver helps mobile devices spend longer on the go



If you're wondering whether the new OS will run satisfactorily on your PC or laptop, the good news is that Windows 10 has the same official hardware requirements as Windows 7 and 8, so performance shouldn't be an issue. As for stability, *PC Pro* staff have certainly seen blue screens and quirky drivers during the preview period – but after nine months of public testing and telemetry, Windows 10 is the most scrutinised edition of Windows ever, with every crash relayed back to Microsoft and analysed. If you're happily running Windows 7 or 8, there's no reason to expect trouble from the final release of Windows 10.

What about the user experience? If you're coming from Windows 8 on a laptop or desktop, you have everything to gain. While the latest 8.1 update resolved the worst quirks, the lack of a desktop-friendly Start menu remained a frustration, as did the very limited support for running apps apart from in full-screen mode.

The same is true for compact touchscreen devices. Alongside the new features detailed elsewhere, it brings a choice of operation modes – Desktop and Tablet modes – which you can switch between by dabbing a button in the notifications centre, or by docking or undocking a convertible device. You get a full-screen Start menu and apps when you want them, while the conventional desktop remains always at hand.

There's yet more for tablet users. The new OS refines the touch controls, replacing the awkward edge-swipes of old with multi-finger gestures. Plus, while Universal apps can be made compatible with Windows 8.1, we anticipate that developers will focus on Windows 10: Microsoft has led the way, releasing previews of the Office, Excel and PowerPoint mobile apps as Windows 10-only.

The only constituency with a good reason to stick with Windows 8 is Media Center users. The much-loved media manager has been discontinued in Windows 10, considered redundant in an age of smart TVs and Xbox One media apps. Everyone else, though, will surely be happier and more productive after the upgrade.

If you're currently using Windows 7, you may be more apprehensive. The veteran OS still does a perfectly good job, and if you've been using it for this long without feeling the need for mobile-type apps, you may not be eager to jump onto a platform designed for a different world. That will surely be the case if you're using Windows 7 for work, as many are.

But although Windows 10 aims to be more than just a desktop OS, Microsoft knows that the non-touch, standalone laptop is still the most common Windows platform.

You can still use the Start menu as before, and run all the same

applications: there's a slight learning curve involved in the new Settings app and the Edge browser, but to offset that you get the benefit of the new Explorer features. It's easier than you might think to keep on trucking.

Upgraders from Windows 7 will also gain all the best features introduced in Windows 8: the enhanced Task Manager provides a welcome insight into system activity, and OneDrive – with a generous 15GB of free space – makes

Windows 10 for business

Companies running Windows 7 or 8 Pro can upgrade their desktop clients via the free upgrade programme, while those on a volume licensing agreement can roll out Windows 10 Enterprise whenever they want. By now the feature set will be familiar: the professional releases include everything in the Home edition, plus BitLocker encryption, Hyper-V, group policy management, domain support and the ability to act as both client and server in a remote desktop session.

These editions of Windows 10 also feature Windows Update for Business, which frees businesses from having to keep the OS constantly up to date. Devices running Windows 10 Pro have the option to switch to

an update stream entitled "Current Branch for Business", which allows non-critical updates to be deferred to allow time for testing. Note that they can't be skipped altogether, and it remains to be seen how long the window will be in practice.

Windows 10 also introduces the new idea of Long-Term Servicing Branches (LTSB) – builds of the operating system that can optionally receive critical updates but don't otherwise change at all.

New branches will be issued periodically, and will receive mainstream support for five years after their issuance, with a further five years of extended support available. Only Windows 10 Enterprise – and the Education edition – have access to these branches. LTSB installations of Windows 10 Enterprise also come with Internet Explorer as the default browser rather

than Edge, to maintain compatibility with legacy applications, while Pro users have the option of using either.

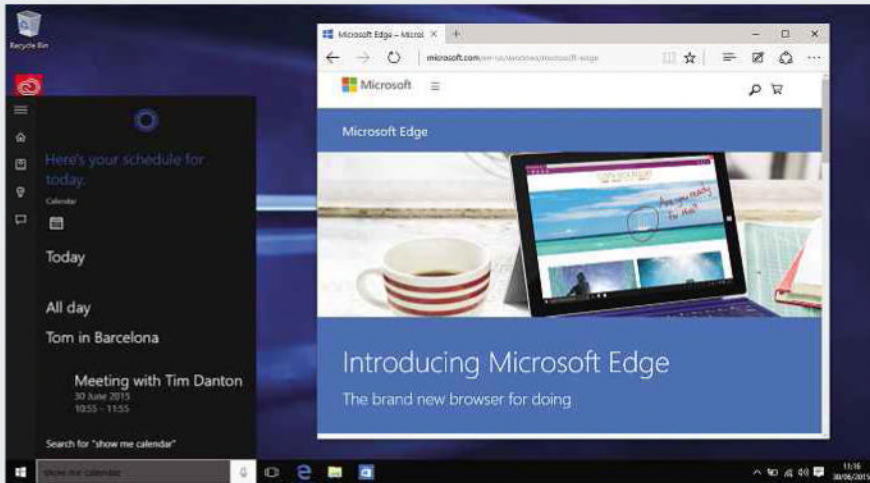
When it comes to device management, Windows 10 builds on Windows 8, with new options for administering company-owned hardware: there's support for managing multiple users on the same device, using a container model. Clients can also log in using their Azure IDs, and connect directly to Azure Active Directory resources.

Finally, Windows 10 brings the ability for firms to curate their own app stores, for easy distribution of bespoke apps. Of course, this requires an investment in the Universal app platform, but since these apps are lightweight and sandboxed, and easy to assemble in a visual environment, it's a good fit. It doesn't hurt that they'll also run on Microsoft smartphones – as well as tablets and laptops – once Windows 10 Mobile arrives.



10 great new features in Windows 10

If the Start menu, Cortana and Edge aren't enough, check out these additional enhancements



1 The **Action Center** slides in from the right of the screen with a fuss-free tap, letting you review recent alerts. You can also easily access settings such as brightness and networking.

2 The **Task View** button gives an instant overview of your windows, from which you can click to jump directly to a particular application or document.

3 For those who like to compartmentalise their windows, a new **virtual desktop** feature lets you set up and switch between workspaces.

4 The **Settings** app offers almost every adjustment you'll want to make – ending the confusing split between the control panel and Windows 8's full-screen PC Settings interface.

5 The **Quick Access** section in Explorer windows lets you jump instantly to recently accessed folders – one of those capabilities that quickly becomes indispensable.

6 The **Battery Saver** feature dims the screen and disables app features when your battery charge falls beneath a certain level. It can also track how much battery power individual applications have used.

7 **Windows Hello** lets you log on biometrically, using hardware such as a camera or fingerprint reader, while the new **Passport** framework carries your identity forward to applications and websites.

8 System files are **automatically compressed** to save space on compact devices.

9 Windows 10 can **connect to your Xbox One** console, allow you to stream and record console games on a tablet or PC.

10 For gamers, **DirectX 12** promises improved performance, through a new architecture that gives developers better access to the graphics hardware.

it easier to hop between devices. There's improved multimonitor support, and the File History system that permits continuous backup to a connected external or network drive. And that's in addition to much faster startup and reboot times. All told, Windows 10 makes a better desktop OS than Windows 7.

There's one more consideration: Windows 7 is now out of mainstream support. Security patches will continue, but otherwise the software is frozen, and in 2020, it will stop being supported altogether. By contrast, Windows 10, with its rolling update model, should never expire – so there's every chance you'll want to get onboard sooner or later. That being the case, it's a good idea to claim your upgrade while it's free. It's conceivable that Microsoft might end up making the OS free forever – but we wouldn't bank on it.

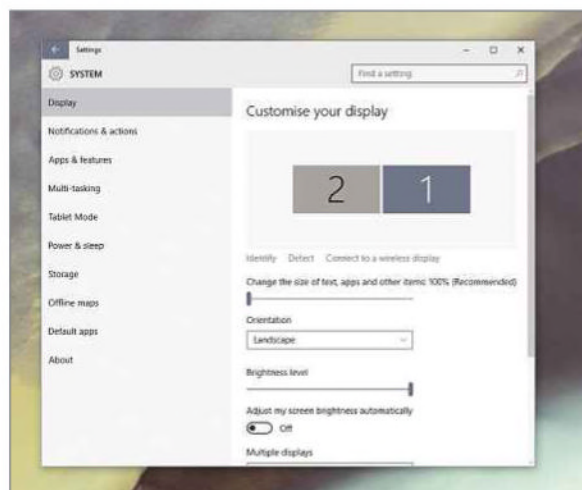
For those running a Windows 10 Insider Preview build, your upgrade options depend on how you installed your preview. If you upgraded from Windows 7 or 8, then you'll get the option to install the full release when it's available; if not, you'll need to reinstall your old OS to upgrade. Otherwise, you'll continue to receive preview builds of forthcoming updates indefinitely.

Looking forward

As we've indicated, switching to Windows 10 isn't a one-off change; it's a step onto a perpetual conveyor belt of upgrades. The first update is expected as soon as this autumn – perhaps updating the Edge browser – with a more substantial update coming down the line next year.

That being the case, you might understandably be concerned that your hardware could start to struggle as the OS develops. The user experience could be volatile too: Microsoft has already showcased the idea of interactive Live Tiles for

BELOW The **Settings** app makes a tasteful alternative to the old control panel



a future update. With a few changes like that, Windows 10 could morph into something quite different to the platform before us today, and there's no guarantee that we'll like it.

Yet there are reasons to be upbeat. So far, Microsoft has shown good taste with Windows 10, listening to customer feedback through the Insider Hub app. And since the Insider Programme continues after the formal release of Windows 10, volunteer testers will have a chance to flag up any disastrous decisions before they're rolled out to regular users.

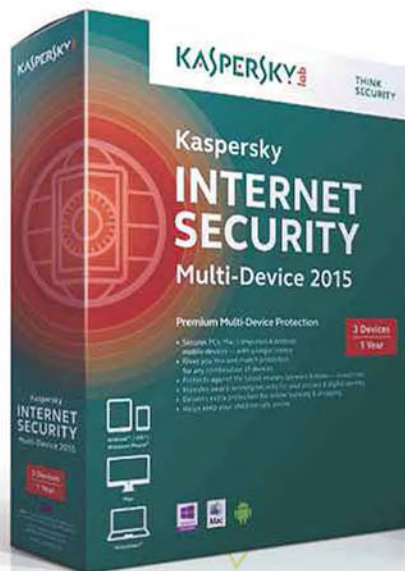
So overall, Windows 10 is a hit. On the desktop it feels as right as Windows 7, yet it's equally at home on compact tablets. Is it the perfect OS? No: Cortana falls some way short of the perfect virtual assistant, while aspects of the design lack slickness.

But it's absurd to focus on such little things when the significance of Windows 10 is so big: if universal apps take off as they deserve to, that will be a persuasive reason to consider Windows 10 for your next tablet or smartphone. Even if that doesn't happen, Windows 10 is still – without a doubt – the best OS for any desktop, laptop or convertible that's capable of running it. If you haven't already claimed your upgrade, hesitate no longer. **DARIEN GRAHAM-SMITH**

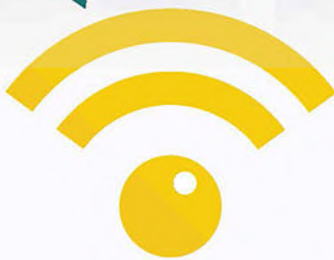
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Kaspersky Total Security RRP £59.99 and Kaspersky Internet Security Multi-Device RRP £49.99

Google Chromebook Pixel (2015)

A beautiful, powerful and thoughtfully designed piece of technology – yet still hampered by Chrome OS

SCORE ★★★★★

PRICE Core i5/8GB RAM/32GB SSD, £666 (£799 inc VAT); Core i7/16GB RAM/64GB SSD, £833 (£999 inc VAT) from store. google.com/pcpro.link/251pixel

The new Chromebook Pixel is a world apart from the cheap and cheerful hardware that usually populates the category. Like Google's original flagship, it has more in common with the luxury laptops in this month's Labs (see p78).

As soon as you start to use it, you notice thoughtful touches. The speakers are sited beneath the keyboard to preserve the Pixel's sleek lines. The sturdy "piano hinge" serves both as a heatsink and a Wi-Fi antenna. The multicoloured, segmented LED on the lid glows all the colours of Google's logo when the Pixel is on, and doubles as a battery gauge when the lid is closed: just tap the lid twice and it will show you how much power you have remaining.

The keyboard backlight glows only when you rest your fingers on it; when you lift your hands off, its gentle glow fades away. Careful thought has even been put into the arrangement of ports: the Pixel offers one USB Type-C port on each side, so you can choose which side to plug in the charger. There's also a pair of USB 3 ports and an SD slot, so you can transfer files and plug in peripherals too.

The Pixel's most conspicuous strength is its screen. It's immensely satisfying to use, offering a spacious 3:2 display ratio, and a razor-sharp 2,560 x 1,700 resolution. Viewing angles are perfect, colour accuracy is decent, and it's bright and punchy.

It's also a touchscreen, allowing you to prod, poke and swipe your way through Chrome OS. It responds perfectly, although whether you really need it is another question. I found myself rarely wanting to jab at the display, simply because the glass-topped touchpad is so good.

BATTERY: video playback, 11hrs 24mins



The keyboard is a different matter. The layout, spacing of the keys and feel are all fine, but I'd hoped for more positive feedback and travel. Given how good the rest of the Pixel's design is, that was a disappointment.

Still, there's very little else here to grumble about, least of all the hardware. The £799 edition I tested has a 2.2GHz Core i5-5500U processor backed by 8GB of RAM, which is more than generous for a Chromebook; the £999 LS ("ludicrous speed") edition features an even faster Core i7 CPU and 16GB of RAM.

The Core i5 edition zooms along at such a speed that we can't see why you'd ever need the Core i7. Even with 20 Chrome tabs open, it flew along; we never witnessed the slightest lag while scrolling and zooming around hefty web pages.

Running a few browser-based benchmarks produced suitably impressive figures: the Core i5 Pixel finished the SunSpider browser test in a rapid 196ms, delivering a Peacekeeper result of 4,432 and a WebGL Cubes frame rate of 30fps. Needless to say, this is the fastest Chromebook we've tested.

One reason you might consider the Core i7 model is that it also has a larger 64GB SSD than the Core i5's 32GB drive. But since you can add extra storage via the SD slot, this isn't particularly cost-effective.

The most impressive thing about the performance of the Pixel is its battery life. Google hasn't published a milliamp-hour rating, but where most Chromebooks can't stretch past seven hours of continuous video playback, we found the Pixel kept going for more than 11 hours. This

ABOVE The new Chromebook Pixel is as stylish as any Ultrabook

"The Pixel's most conspicuous strength is its screen, offering a spacious display ratio and razor-sharp resolution"

+ Superb design, screen and performance – and great battery life too
— Chrome OS still can't fully replace the traditional desktop

means you can expect a full day of use, and then some, without needing to reach for its charger. And since the Pixel is so efficient in standby, similar to an iPad, you can leave it in this mode without having to worry about the battery being dead when you return hours or even days later.

All told, if you're tempted by a Windows Ultrabook or a MacBook Air, you'll find plenty to like about the Pixel. The issue is, as ever, the limitations of Chrome OS. For sure,

it's matured greatly over the years, gaining offline capabilities and hundreds of new features and apps; as Wi-Fi has become more pervasive, it's become a perfectly viable OS for casual tasks. Yet there are still plenty of professional tasks that simply can't be done satisfactorily on a Chromebook – no matter how powerful, no matter how useful.

When you consider what else you could buy for a similar sum – or, at worst, a few hundred pounds more – that makes it very difficult to justify the Chromebook Pixel. It's a superb machine, of that there's no doubt; but at this price it needs to be a complete alternative to an Apple or Windows laptop, and we're sorry to say that, as a platform, Chrome OS still isn't quite there. **JONATHAN BRAY**

SPECIFICATIONS

2.2GHz Intel Core i5-5500U • 12.9in 2,560 x 1,700 touchscreen • Intel HD Graphics 5500 • 8GB RAM • 32GB flash storage • 2 x USB Type-C • 2 x USB 3 • SD slot • 720p front camera • 802.11ac Wi-Fi • Bluetooth 4 • Chrome OS • 2yr RTB warranty • 298 x 225 x 15mm (WDH) • 1.5kg



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To enter simply visit pcpro.link/excellence15
Closing date: 31 August 2015

WIN

Chillblast Lynx tablet

The Chillblast Lynx is an 8in Windows 8.1 tablet with an ultra-sharp 1,280 x 800 IPS display. Inside, it features a quad-core Atom processor, 1GB of RAM and 16GB of internal storage, expandable via a microSD slot. Worth £108.

chillblast.com

Chillblast



WIN

Kaspersky Total Security

Consistently rated the best antivirus software in our independent tests, Kaspersky Total Security also offers phishing protection, powerful parental controls and a built-in password manager. We have ten 12-month subscriptions to give away, worth £35 each.

kaspersky.com

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Lenovo Yoga 3 14in

The Yoga 3 is a limber 14in hybrid with a potent specification – but it's found lacking where it counts

SCORE ★★☆☆

PRICE £708 (£800 inc VAT) from lenovo.com/yoga (pcpro.link/251yoga)

Lenovo's Yoga hybrid design is elegant in its simplicity. Take a standard laptop, add a touchscreen and throw in a hinge that allows the display to fold back through 360 degrees. The device can thus transform into a giant tablet, prop up in a "tent" mode for video or presentations, or contort into "stand" mode with the keyboard face down.

With its 14in screen, the Yoga 3 is the largest Yoga yet: at 1.65kg and 18.5mm thick, it's not a device you'll want to use in tablet mode regularly. It's not much of a looker, either: it lacks the fancy watch-strap hinge of the recent Yoga 3 Pro, and the matte-silver plastics covering the base and lid (retail models will also be available in white) fall short of delivering a premium feel.

Thankfully, the same isn't true of the internals. The £650 model comes with a 2.2GHz Core i5 Broadwell CPU, 4GB of RAM and a standard HDD paired with 8GB of solid-state cache. The £800 model on review here bumps up the specification to a 2.4GHz Core i7-5500U CPU, 8GB of RAM and a 256GB SSD.

Yet despite those powerful components, the Yoga 3 fared quite poorly in our benchmarks, with an overall score of 33 – 26% behind the similarly equipped Asus Zenbook UX303LA. While right on target in the image-processing section of our benchmarks, the Yoga 3 dropped 16% behind the Asus in the video-encoding test, and was

61% off the pace in the multitasking tests. The CPU doesn't run hot and there's no obvious throttling; nor are there any rogue processes languishing in the background – it's thoroughly odd.

Battery life was pretty good, however. With a 720p video looping constantly, Wi-Fi switched off and the screen brightness set to 120cd/m², the Yoga 3 lasted a credible 8hrs 22mins.

The Full HD touchscreen looks good too, at least on first glance. The IPS panel is crisp and consistent from every angle – an essential trait for a display designed to be used in multiple modes. The gloss finish also helps images pop off the screen.

Look more closely, however, and it's clear Lenovo has cut a few corners. Contrast hits an impressive ratio of 1,193:1, but brightness tops out 240cd/m² – not much better than we'd expect from a budget laptop. Colours lack punch too: our tests revealed that the IPS display can reproduce only 60% of the sRGB colour gamut. Dark shades in particular get crushed, so watch a moodily lit movie and you'll be left wondering what's happening in the shadows.

Despite the Yoga 3's size, connectivity is limited, with only two USB 3 ports available for connecting peripherals. However, since the power supply connects via a modified USB connector, you can use the socket as a supplementary USB 2 port when you're not charging the device. The micro-HDMI connection is maddening: there's plenty of space for a full-sized port. The SD slot leaves

the card jutting out by a centimetre or so, as well. Still, 802.11ac and Bluetooth 4 are welcome, and the 0.9-megapixel webcam is fine for video chats – even if images do fizz with noise and edge-enhancement artefacts.

The Yoga 3's keyboard feels good thanks to the snappy feedback from the rubberised, backlit keys, but the layout takes some getting used to, primarily due to the row of buttons to the right of the Enter key. I often found myself hitting the End or PageUp keys by mistake.

The touchpad is mediocre, with too much friction to deliver smooth control, and a buttonless design that's plain aggravating. Thankfully, the touchscreen is sensitive, responsive and accurate.

I'm a fan of Lenovo's Yoga range, but for £800 I expect a great display and ergonomic design as standard. The

Yoga 3 doesn't deliver on either count. In fact, it doesn't really deliver on the Yoga concept at all: it's too bulky to use effectively as a tablet, while limited connectivity and a middling screen make it a poor laptop. I suggest you check out the Asus Zenbook UX303LA (see p89) instead: it's faster, better-looking and far more refined. **SASHA MULLER**

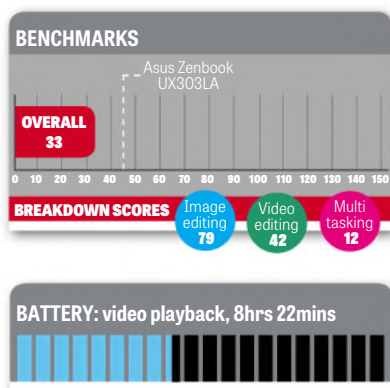
SPECIFICATIONS

2.4GHz Intel Core i7-5500U • 8GB DDR3 RAM • 256GB SSD • 14in 1,920 x 1,080 touchscreen • Intel HD Graphics 5500 • 802.11ac • Bluetooth 4 • 1yr RTB warranty • 335 x 230 x 18.5mm (WDH) • 1.65kg (1.85kg with charger)

ABOVE Aside from the hinge, the Yoga 3's design is quite ordinary

ABOVE The Yoga design enables the screen to be rotated into stand mode

➕ Good specification for the money, flexible design
➖ Mediocre touchpad, unimpressive display



HP Pavilion Mini

An attractive desktop, the HP Pavilion Mini joins a growing band of sensibly priced, compact PCs

SCORE ★★★★★

PRICE 300-030na, £298 (£350 inc VAT)
from store.hp.com (pcpro.link/251hpmi)

A quiet revolution has been taking place in the desktop PC world. As big-box systems have dropped out of sight, manufacturers have turned to minimalist boxes. Now, HP is throwing its hat into the ring with the Pavilion Mini. A design that calls to mind a more rounded Mac mini, and with plenty of space for movies and photos, it joins a steadily growing clan of like-minded machines aimed at reclaiming the PC's place in the home.

The Pavilion Mini is a small but handsome machine. The silver plastic chassis is sufficiently neutral to complement most home or office surfaces, and stylish enough that you won't be ashamed to leave it on show. If you do want to tuck it out of sight, it's small enough that achieving this feat shouldn't be too hard: it's about the size of a soup bowl.

Despite the size, there's plenty of flexibility on offer. At the front, you'll find two USB 3 ports next to the power button, while the right-hand side houses an SD slot. At the back is the neatly arranged business end of the machine, where you'll find the power connector, an audio combo jack, a Kensington Lock slot, a Gigabit Ethernet port and two further USB 3 ports, plus an HDMI port and a full-sized DisplayPort.

If you're looking to upgrade, it's easy to get at the guts of the Pavilion Mini – although doing so will void your warranty. You can easily remove the rubber base to expose three screws; undo these and lift the chassis to reveal the Mini's innards. From here, it doesn't take much

work to replace the hard disk, access the motherboard's pair of SODIMM slots (one of which is free) and get at the system's wireless card.

This makes it a touch more flexible than a Mac mini, but it can't match the Acer Revo One RL85, with its instantly accessible twin hard disk bays. There are design disappointments, too. The basic 802.11n wireless card is only single-channel (so you can't connect to a 5GHz network), although you do get 2 x 2 MIMO support. The power supply is an ugly black brick that

ABOVE The physical design is tasteful, but still conveys a likeable sense of personality

BELOW The Pavilion Mini offers a decent range of ports

achieved a credible score of 46 in our image-editing test – indicating enough single-threaded power for everyday desktop tasks, from web browsing to HD movie streaming. It struggled with the most taxing test, however, with a poor multitasking score of 5 that dragged its overall score down to 21. That's on par with the Core i3-equipped Revo One RL85, which scored 19.

With Intel HD Graphics 4400 on board, graphically demanding games won't be on the menu, but mid-level titles such as Minecraft and League of Legends are perfectly playable.

At £350, the HP Pavilion Mini is certainly affordable, but its rivals are competitively priced too. Apple's Mac mini is £50 more expensive at its base configuration, but it boasts a beefier Core i5 with Iris Pro graphics – which drove it to a much more impressive overall score of 46 in our benchmarks.

And while the HP has a bigger

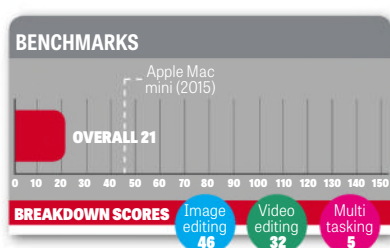
hard disk than the Mac mini, it's more than outmatched in that area by the Core i3 Acer Revo One RL85, which boasts double the storage, at 2TB, with room for an extra pair of hard disks

– and it comes with a keyboard and a mouse in the box for a similar price.

Overall, the HP Pavilion Mini is a practical little PC, and attractive too. But it's not the most desirable, powerful or flexible compact PC around. **THOMAS McMULLAN**

"The Pavilion Mini is a handsome machine; the silver plastic chassis is stylish enough that you won't be ashamed to leave it on show"

+ Cute design, decent range of ports for its size, possibility of user upgrades
– Unremarkable performance, last-gen Wi-Fi



SPECIFICATIONS

1.9GHz Intel Core i3-4025U • Intel HD Graphics 4400 • 4GB RAM • 1TB 5,400rpm hard disk • Gigabit Ethernet • 4 x USB 3 • HDMI • DisplayPort • SD slot • 802.11n Wi-Fi • Bluetooth 4 • Windows 8.1 64-bit • 1yr C&R warranty • 144 x 144 x 52mm (WDH) • 630g



Adobe Creative Cloud 2015

Another round of updates for Adobe's Creative Cloud suite, including an intriguing glimpse of the future

SCORE ★★★★★

PRICE Complete suite, £38/mth (£47/mth inc VAT) from adobe.co.uk (pcpro.link/251adobecc)

Last year's Creative Cloud update was the most significant since the inauguration of Adobe's subscription payment model; 2015's "milestone" release is less extensive. The applications do benefit from updates, but the biggest development doesn't relate to the suite's major applications. Instead, the major addition in CC 2015 is a new service that plugs into those apps: having already extended the suite with the Typekit font library, Adobe is now getting into stock photography.

Adobe Stock and Linked Assets

If the bank of images, illustrations and vectors in Adobe Stock looks familiar, there's good reason. Its 40 million or so images come directly from Fotolia, acquired by Adobe earlier in 2015. It won't have had much chance to stamp its own ethos on the content just yet.

Rather, the work has been on integration with the Creative Cloud apps, and here Stock works in a similar way to Typekit. At its simplest, you can carry out a keyword-based search from the Adobe Stock website, and then download images in the browser. But this is possible with

any stock-image website; the advantage of Adobe's offering is that you can carry out searches within the Creative Cloud applications. Search results appear in a web browser, but selected images are then imported into your Creative Cloud Library folder, which can be accessed within the CC applications themselves.

It's important to note that Adobe Stock isn't free to Creative Cloud subscribers. Single images cost £6 each, while the basic subscription costs £20 per month for up to ten images; these prices won't scare other photo providers.

Stock's big selling point is that users can download and work with free watermarked images within Photoshop, Illustrator or InDesign, then seamlessly update those images with the full-resolution, non-watermarked versions by simply clicking the "License image" option in the Library panel. That's certainly an improvement over most stock-image workflows, but Adobe's system needs some work. For instance, the web



TOP After Effects gains new face-tracking features

ABOVE Add clarity to photos that are low on contrast using the new Dehaze tool

BELOW Adobe Stock allows you to search for photos from within its applications

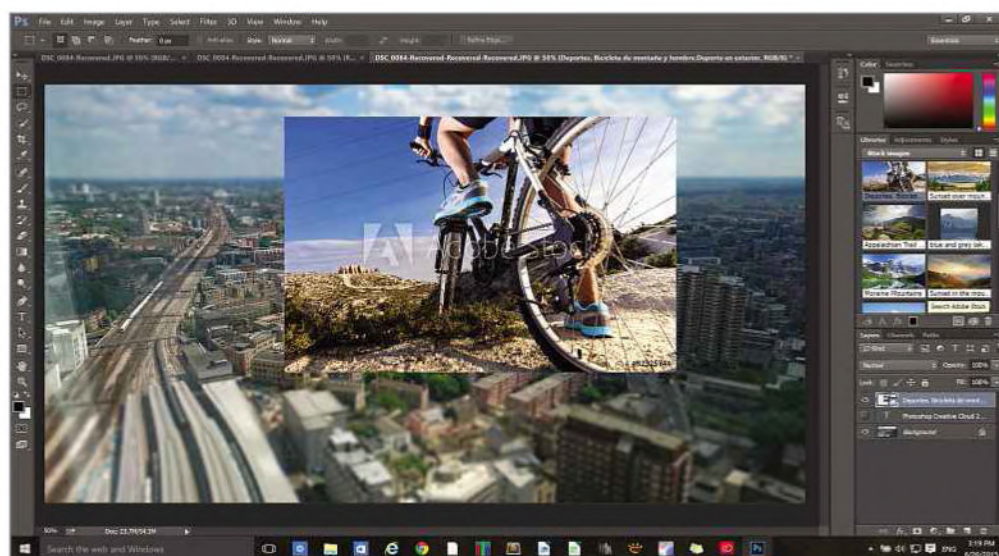
interface is basic, yet still manages to confuse. If you click on an image for a closer view, the option to save directly into your libraries disappears. And while working with watermarked photos is fine, it's not as effective for vectors, as you can't tweak elements until you purchase the photos.

Another new cross-CC feature is Linked Assets. This builds on CC's existing Libraries features, allowing users to keep commonly used graphics up to date across multiple projects. Edit the graphic, save it into your library and, as long as that graphic has been placed as a linked item, it will instantly update across all the projects in which it's been used.

Photoshop and Lightroom

With all the work going on in Stock, the major apps haven't received as much attention. Photoshop's big new feature isn't new at all – it's inherited from Illustrator. The Artboards feature allows you to set up several differently sized workspaces within a single PSD file. It's aimed at those designing artwork for several device types at the same time – for an app and a responsive website, for example.

You get presets based on popular devices and screen sizes, plus the option to define your own custom artboards, should the need arise. The most powerful feature of Artboards is



its ability to work in conjunction with the new OS X-only Device Preview app, which can pipe previews directly to USB-connected iPhones and iPads for a real-time, real-world preview.

Both Photoshop and Lightroom gain a new tool as well. “Dehaze” proves remarkably adept at adding clarity to photos that are low on contrast. It can also be used to add haze to an image for a more dreamy quality. The standalone Lightroom 6 product won’t receive this update; it’s for CC subscribers only.

Elsewhere, there’s an overhaul of the Layer Styles box, so you can now add multiple instances of the same effect to a layer – allowing the creation of multilayered drop shadows, for example. The Photomerge tool can now take advantage of Photoshop’s Content-Aware Fill feature to fill in the jagged curves along the top and bottom of multi-photo panoramas – a feature that has already been in Photoshop Elements for years.

There’s also an interesting preview feature dubbed Design Space, which is essentially a cut-down Photoshop UI implemented in HTML5. It’s too simple for serious use, but in a world increasingly moving to platform-independent tools, it’s a fascinating hint that the ultimate endgame for Creative Cloud might be online apps.

■ Illustrator and InDesign

While the photographic applications get some decent new features, the rest of the core apps haven’t been so lucky. Headlines for Illustrator include a performance boost and a (currently) limited update to the charting tools.

The former comes thanks to GPU acceleration, allowing real-time click-and-drag panning and zooming – just like Photoshop, in other words.

The new Creative Cloud Charts feature is part of Adobe’s “Technology Previews”, and as such, it’s officially a work in progress. As the name

suggests, this isn’t a conventional upgrade, but a new hybrid, cloud-based service, which (peculiarly) requires chart values to be entered in a browser instead of a dialog box. The graphs appear in Illustrator as normal, but this isn’t a regular graphing tool: it’s aimed specifically at the creation of infographics, with the ability to scale graphics based on values, rather than using plain bars or columns.

Finally, Illustrator gains a crash-recovery feature, similar to that of InDesign. If you run out of battery mid-task or Illustrator crashes, you can now pick up where you left off when the app restarts.

InDesign’s major new feature is Publish Online, another Technology Preview, which lets you share documents over the internet via the browser. Available through the File dropdown menu, this mirrors your InDesign document to a publicly accessible URL, and can preserve even the most advanced features – such as animations and embedded video – all using the magic of HTML5.

■ Premiere Pro and After Effects

The major changes in Premiere Pro focus on colour workflow. The app gains the real-time videoscopes previously only available in Adobe SpeedGrade, and there’s also a new set of colour-correction tools via the Lumetri Color panel, opening

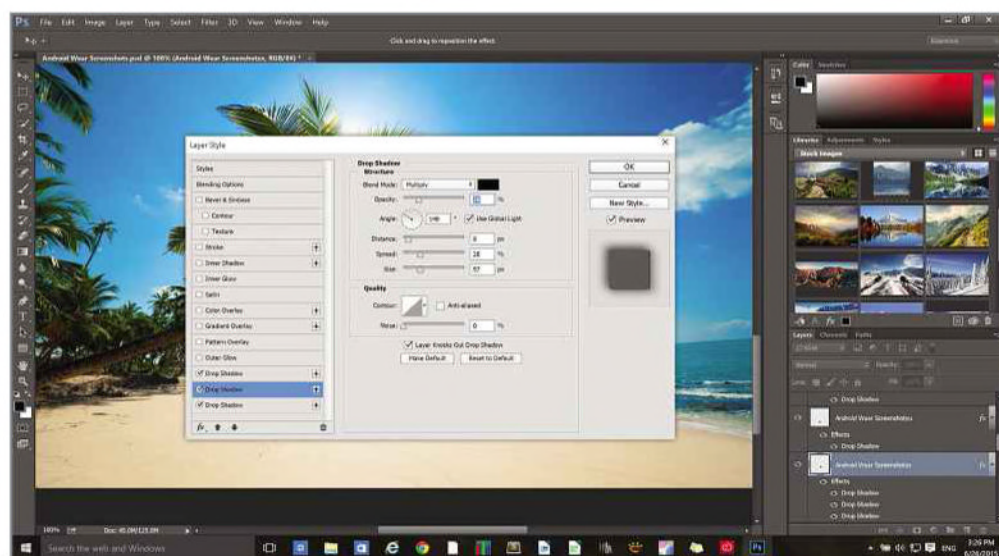
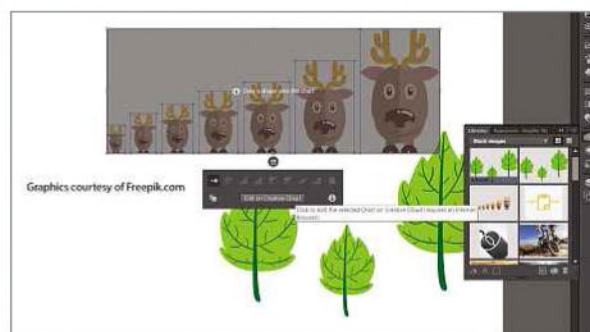
Progressive improvements to almost every application

The larger updates make a big difference to most workflows

“Illustrator gains a crash-recovery feature, so if you run out of battery mid-task you can now pick up where you left off”

BELOW With Creative Cloud Charts, you can create infographics

BOTTOM Create multilayered drop shadows using the Layer Styles box



up more refined colour correction to videographers and film editors.

Slightly less universally important, but useful in certain circumstances, is the new Morph Cut feature. This uses face-tracking to remove material in interview sequences, and smooth out jump cuts by interpolating (morphing) between frames, with the idea that you don’t need to apply a distracting crossfade or cut to B-roll. It works well: depending on the your subject’s mobility, it can be tough to spot the transitions if you’re not looking for them.

After Effects takes a similar tack, with one enormously practical, yet rather dull, update and a couple of

more eye-catching changes. The first will have an enormous impact on anyone who spends their days in After Effects: at last users can make changes to an open project – adjusting parameters

and so on – while a preview is playing, without it pausing.

The Face Tracker and Character Animator features are a bit more fun. Face Tracker allows you to apply effects to people’s faces within a clip and have them follow that face around the frame. It’s handy if you need to blur out a child’s face in a news clip, for example, and features such as the eyes, nose and mouth can be tracked independently.

That data can then be exported for use in the new Character Animator application, currently in preview. With this application, you can either use captured facial information from After Effects to animate 2D characters’ features, or use your webcam to capture facial movements and apply them in real-time.

■ Verdict

Other changes of note include Dreamweaver’s improved tools for responsive website design, the integration of Typekit with Adobe Muse and the introduction of the Adobe Photoshop Mix, Brush CC, Shape CC and Color CC mobile apps to Android. Other improvements are mostly small and incremental. Still, Adobe’s applications are already so powerful, and Creative Suite so vast, that it continues to amaze me that Adobe can find anything at all to add or make better.

Perhaps features such as the new HTML5 Design Space interface, Creative Cloud Charts and the move into stock photography point the way. Bit by bit, Adobe is extending its behemoth online; it can’t be long before Creative Cloud’s entire centre of gravity starts to shift in that direction. **JONATHAN BRAY**

PREVIEW

Android M Developer Preview

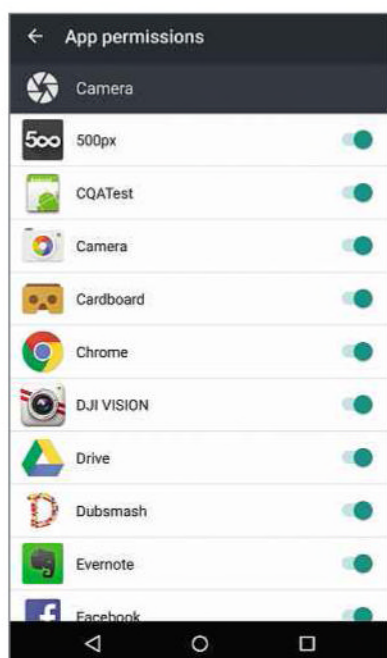
Google delivers the first taste of Android M for developers and brave early adopters

The latest version of Google's mobile operating system was introduced at the company's I/O conference in San Francisco in May. For now it's known only as Android M: a proper confectionery-themed name will be unveiled along with the final code, probably around September. For app creators who need to test their work, however – and tinkerers who want to try the very latest code – a Developer Preview release is available right now. We've taken the plunge and installed it on the Nexus 6, to see how the new features are coming together.

Setup and UI changes

Google changed the Android setup procedure substantially last year, introducing a cleaner, simpler process, with selective restoration from your cloud data. This year, bar a slight colour change from light-blue to dark-blue graphics, the process is largely the same.

It's a similar story with the general look and feel of the UI; there's no change to the overarching design language of Android. Throughout the OS, Google has maintained the visual motif of floating flat cards – a look it calls "Material Design" – which it introduced last year.



There are, however, some smaller visual changes. The most significant of these sees a dramatic retooling of the app tray. Instead of scrolling sideways, it now scrolls vertically, with a search field and a list of four "favourite" apps up top to help you jump straight to what you're looking for. If you prefer to scroll and browse, there's also a letter index running along the left-hand edge of the screen.

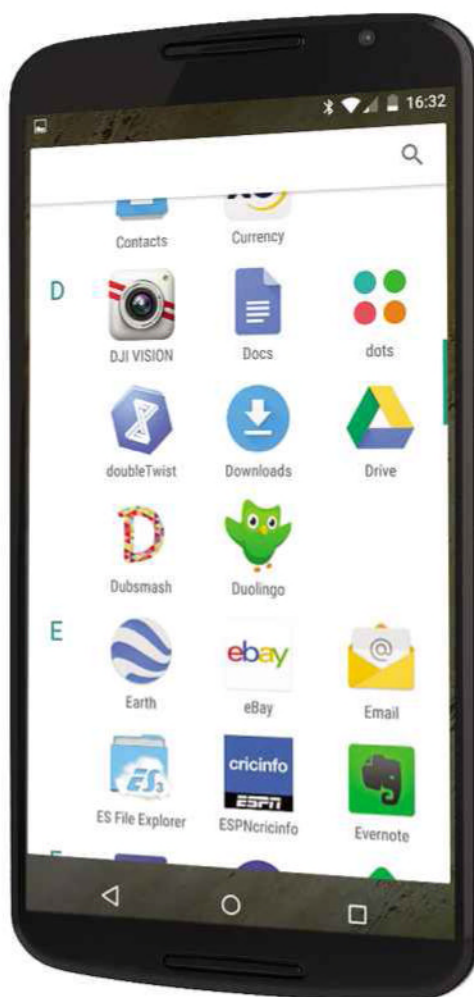
The latter is a nice touch, but dividing apps into alphabetical blocks leads to a ragged, ugly-looking list. It doesn't help that on the Nexus 6 the view currently defaults to three icons across, which, on the large 5.96in display, looks oddly empty. We hope Google will introduce scaling options for larger phones before Android M hits the mainstream.

There are also improvements to the way volume control is handled between apps, alarms and ringtones – something for which the current Lollipop release has been criticised. Android M makes this useful part of Google's mobile OS much simpler: the confusing "None", "Priority" and "All" links below Lollipop's single volume control have been replaced by a new "Do Not Disturb" button in the toggles area of the Notifications dropdown menu. Tap this icon and you'll see three options, which are again much easier to understand than before: "Total silence", "Alarms only" and "Priority only". Each of these can be activated indefinitely, or for a set period of time.

And that's not all. The volume slider that appears whenever you click the up/down rocker buttons on your phone now has a dropdown arrow to its right, which allows you to quickly tweak media and notifications volume. Another big improvement.

Now on Tap and multiwindow mode

Sadly, the most interesting new feature announced by Google is missing from this early Developer Preview. From what Google has already revealed, however, "Now on Tap" looks very promising.



ABOVE The app tray is now a vertically scrolling list, with alphabetic headings to help you navigate

Simply put, Now on Tap is a proactive implementation of Google Now. It's designed to work not only with information gleaned through your email and search habits, but also with any third-party app you might have installed on your phone or tablet. Chatting with a friend on WhatsApp about the pub you're meeting at tonight? Now on Tap will pop up details of the drinking establishment in question, delivering information such as reviews and directions. It has the potential to be a huge addition to Android, and we can't wait to see how it works in practice.

One innovation that Google didn't flag up at I/O is a new, "highly experimental" multiwindow mode that lets you run two apps side by side – a great idea, especially for larger screens. At present, however,

the feature is hidden away under Developer Settings, behind a warning that apps may crash or malfunction when used in this mode. It remains to be seen whether it will reach maturity in time for Android M, or whether we'll have to wait for a future release.

Permissions and under-the-hood changes

One system-wide change introduced in Android M is a revamp of the permissions system. Google has adopted a dual-pronged approach here, making the system more flexible and less cumbersome to use in one move. There are fewer permissions that apps can request, making the system far easier to understand, and users can now view and revoke those permissions on an individual basis – great news if you want to try out an app without granting it a raft of questionable privileges.

Better still, the new system no longer requires you to agree to all permissions at the time of installation; it will only ask you to authorise a particular type of activity when the app – or a specific feature within the app – is used for the first time.

We suspect that only a handful of users will really grasp the opportunity to take charge of their permissions – the settings remain somewhat hidden away – but at worst the ability for

LEFT Permissions become both simpler and more granular in Android M

Android Wear 5.1

Android Wear 5.1 was recently rolled out to Android smartwatches. It doesn't change much, but it makes Android Wear feel more rounded, more controllable and more intelligent than before.

The first big change is a new app launcher. It's available with a quick swipe from the right edge of the screen (or a tap of the watch face), revealing a vertically scrolling list of apps with the three most recently used at the top.

Swipe right again and you can now view recently accessed contacts – it's possible to dial or text directly from this screen – while a third swipe brings up the old Android Wear actions screen.

The latest version of Android Wear also reduces the need to use two hands to operate your watch. "Wrist gestures" let you scroll through notifications with a quick flick of the wrist, without having to use your other hand, or employ the ungainly "nose dab" technique.

Other enhancements include the ability to respond to incoming texts by drawing an emoji onscreen, which Wear cleverly converts to a proper icon. Google Maps on Wear now displays a fully moving, scrollable map when you

ask Google Now for directions, and Wear finally has its own "Find my phone" option.

Possibly the most significant development is that third-party apps can now make use of Wear's "Always-on" display function – handy for features such as countdown timers and stopwatches.

These updates are all very welcome, but there are still areas that need work. Adjusting screen brightness still requires too many taps if your watch lacks an ambient light sensor. And while the new Wi-Fi sync feature works well, for times when you're out of Bluetooth range, it tends to hammer the battery.

Still, Android Wear is clearly coming on in leaps and bounds. It may have been basic at first, but it's now a mature operating system that feels fully part of the Android family – and the watches themselves are becoming far more useful as a result.



apps to defer permission requests should save time and hassle during bulk and automatic updates.

Another feature that could have hidden benefits shows up as "Domain URLs" in the Settings menu. This allows apps to effectively "own" links from a certain domain, ensuring those open with the same app. Thus, Twitter links will always open in the Twitter app and Facebook links in the Facebook app – unless, of course, you specify otherwise. Again, it's far from an exotic addition, but it should reduce the occurrence of those annoying "Open with..." messages – and thus remove another irritation from the Android experience.

■ Performance and battery life

In terms of performance, not much has changed. Geekbench scores were effectively identical to what we've seen from Lollipop on the Nexus 6, with single- and multi-core scores of 1,011 and 3,219 respectively. Browser performance has dropped a little: the SunSpider browser test took 1,080ms to complete on Android M, versus 806ms on Lollipop; that may be tightened up before the final release. Sadly, we haven't yet been able to persuade GFXBench to install.

We had high hopes for battery life in Android M, courtesy of a new feature called Doze, which disables background processes during periods of low use. In this way, Google claims that Doze can extend standby endurance by a factor of two on the Nexus 9 tablet.

On a phone, though, we doubt you'll see a dramatic improvement. Doze uses your device's movement sensors to detect idle periods, so it won't kick in when your phone is being carried around in a pocket or bag. In our tests, we've noticed no real benefit so far.

■ Conclusions

Unless you're a developer with apps to test, we don't recommend you rush to install the Android M Developer Preview. We've found it remarkably stable, but since the headline feature – Now on Tap – hasn't yet been plumbed in, there's not really a lot here to play with.

All the same, what we've seen so far is all good stuff, aimed at making Android cleaner, smarter and more usable than ever. The new version of Android may not be as much of an upgrade as Lollipop, but we're looking forward to an M-powered future. **JONATHAN BRAY**

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PREVIEW

Apple OS X 10.11 El Capitan

As the annual upgrade cycle continues, El Capitan brings a modest but well-thought-out set of new features

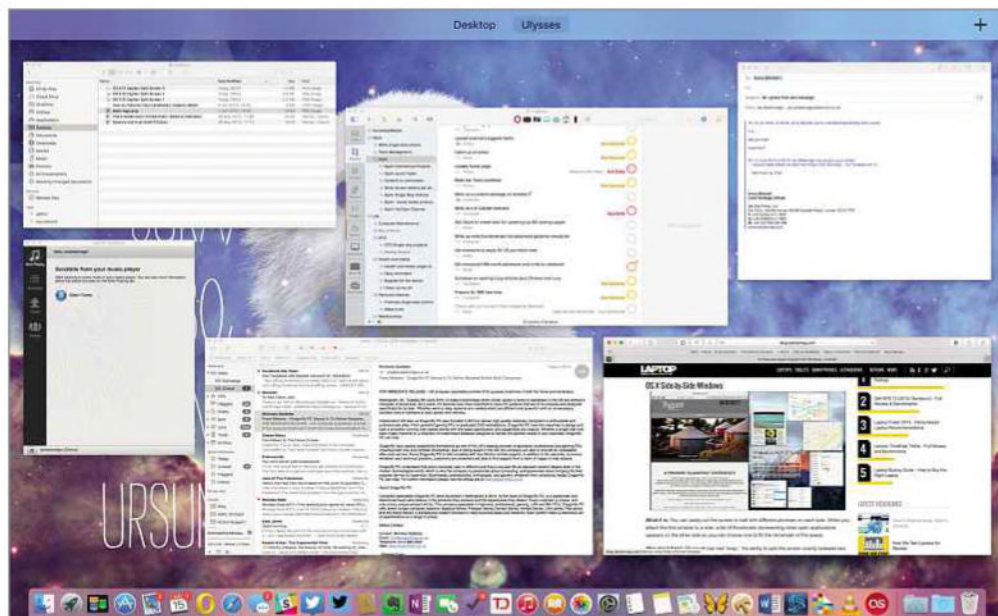
Apple has got into the habit of unveiling a new release of OS X each year at its Worldwide Developers Conference, and this year's update – OS X 10.11, also known as El Capitan – is now available as a developer preview. A public beta is expected to follow, with a final public release in the autumn.

According to Apple, El Capitan focuses on performance and “experience”, rather than new features. That’s no bad thing: at this point, the OS doesn’t need a major revamp. However, this isn’t another Snow Leopard. El Capitan brings a few new tricks that will affect the way we use our Macs for years to come.

The biggest improvement is a change to full-screen view. Taking a single app full-screen has been possible since OS X 10.7 Lion, but one application can’t always give you everything you need; while writing, for example, I often find I want to refer back and forth to a browser.

The answer is El Capitan’s new Split View. Click and hold on the green button in an app’s window bar and you can “snap” the window into half of the screen. You then select a second window to fill the other half of the screen, from a Mission Control-style view. You get a full-screen view of two applications side by side, and you can drag the divider between them to make one wider and the other thinner.

This is of course very similar to the Snap Assist feature in Windows 10 – but that’s not a criticism. Snap is one of my favourite features in Windows, and having something similar in OS X helps me to be more productive when I’m working on the Mac.



You can also now create a new full-screen workspace by simply dragging a window up to the top of the Mission Control view. Previously you could add a new Space via the “+” button at the top of the screen, but dragging windows around directly is much more natural. Put these two changes together and it’s clear that Apple is determined to make full-screen mode a more viable way of working on the Mac.

As usual, Safari has been updated too. The big new feature is called Pinned Sites: any website can now be “pinned” to the left-hand side of the browser window, where it will stay open at all times. Pinned sites are represented by a single letter or icon, making them space-efficient.

Safari also now includes a simple system for showing which tabs are playing audio with an icon on the tab, and allow them to be muted quickly. It makes it much easier to find and silence irritating auto-play videos. You can also play picture-in-picture web video, and use AirPlay to send web video to an Apple TV.

The other bundled apps have received updates, too. Mail now lets you open multiple tabs for emails, and you can minimise open email

windows to a bar at the bottom of the screen, as in iOS 8. Notes gains the ability to save content from other apps via the system-wide Share button. This content is grouped intelligently by the Notes application, so you can quickly survey your saved URLs, images and maps.

One clever little update will please those who use multiple monitors, or a Retina iMac. If you rapidly waggle your finger on the

ABOVE The updated Mission Control makes it easy to drag an application into full-screen view

trackpad, or your mouse, the cursor temporarily grows larger, allowing you to immediately see whereabouts on the screen it is. It’s a small but thoughtful detail.

Another significant change isn’t immediately visible. Metal for Mac is a core graphics technology in El Capitan that promises huge improvements in performance for applications that use it. Because it originated on iOS, it should also make it easier to port applications between the two platforms. Expect a slew of

new, high-performance games to come to the Mac on the back of Metal.

Lastly, something that’s not currently in the developer release is a forthcoming update to Spotlight, which is set

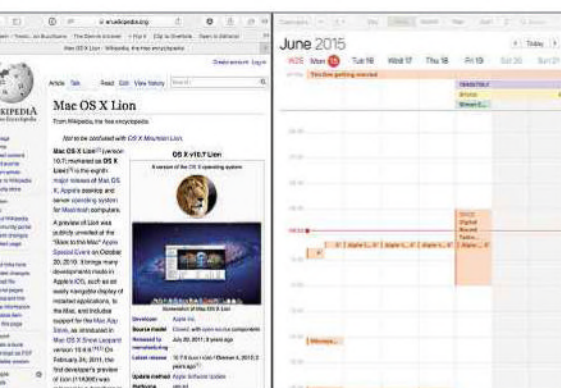
to gain the Siri-like ability to parse natural-language queries, such as “show me all my documents from March”. It will be interesting to see how that works when it arrives.

Although OS X El Capitan is some way from final code, I can already say that the new full-screen features are really welcome. This particular aspect of OS X has felt half-baked since it was released; Split View, Mail tabs and the improved Mission Control make it much more useful.

It’s also interesting to see how OS X and iOS continue to move closer together, in terms of usability and appearance; iOS 9 and El Capitan really look like siblings these days. Apple clearly isn’t going to make the mistake of trying to merge the two platforms fully into one, but they are gradually – and to the limits of their respective hardware – becoming more like each other. That’s what makes El Capitan and iOS 9 together an exciting pair of releases. **IAN BETTERIDGE**

“Snap is one of my favourite features in Windows, and having something similar in OS X helps me to be more productive on the Mac”

LEFT Split View is a great step forward for desktop productivity



PREVIEW

Apple iOS 9

A promising update, with new storage- and battery-saving features that every iOS user will welcome

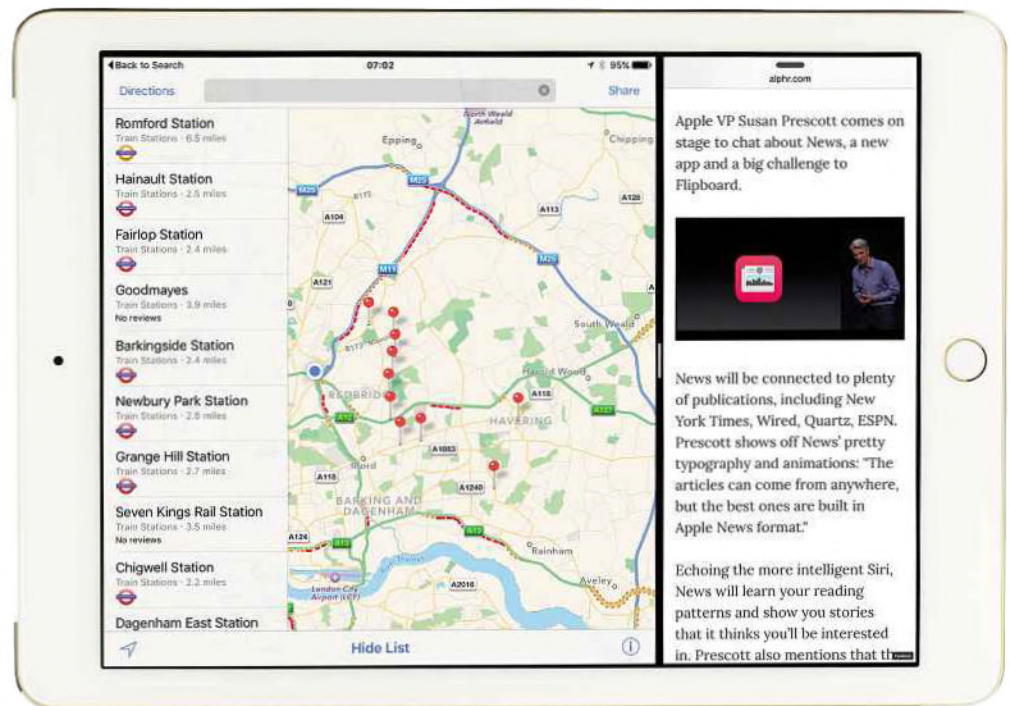
The latest version of iOS is here – or at least the developer preview is, giving us an early look at what's new. For iPad owners, the headline is the new Slide Over mode, which, for the first time, lets you view two apps onscreen at once. You access it by swiping in from the right edge of the screen; you'll then see a list of app icons. Tap to launch an app and you'll see it overlaid on top of your current app in a narrow strip. This makes it a snap to, say, refer to and scroll through a web page while writing an email.

If you have an iPad Air 2, the new Split View goes further, letting you run two apps side by side, jumping back and forth at will. In landscape view you can choose a 50:50 or 70:30 split, depending on your needs.

Only Apple apps are currently supported – third-party developers must hook into the relevant APIs to support the features. And apps in Split View can't interact with each other – there's no drag and drop, for example. The whole thing works better in landscape orientation than portrait: hold the iPad upright and you're stuck with an awkward 60:40 split. There's definite room for improvement before the final release.

Taking a leaf out of Google Now's book, iOS 9 also introduces a more "proactive" Siri, which attempts to offer information before you ask for it. It can now access information from your apps, email and other resources, as can Spotlight search – which makes a welcome return to the left of the main homescreen. All of this contextual information is kept locally, so personal information isn't sent up into the cloud.

On the subject of security, iOS 9 now defaults to a six-digit unlock code – an option in iOS 8 that few chose to activate. And a few space-saving measures will please those running short of storage: the installer has been squeezed down to 1.8GB – much more



convenient than the hefty 4.6GB iOS 8 update – and Apple's new "app-thinning" process shrinks app footprints by installing only the assets for your specific device. On-demand resources will let developers split their apps into chunks that can be downloaded on demand, and cleared when no longer needed.

Another welcome addition is a Low Power mode, which reduces performance in order to extend battery life. It kicks in once your battery drops to 15% capacity, or can be enabled manually. The screen will also stay dark for notifications when the device is facing downwards. Apple claims this can save iPhone users an hour of battery life on average, with Low Power mode extending use by a further three hours.

iOS 9 brings two major new apps: News is a Flipboard-style magazine app that aggregates new stories from multiple sources, while Music is

Apple's all-new streaming service, rivalling services such as Rdio and Spotify. Our feature next month will explore how Apple Music stacks up to its competitors.

Meanwhile, Maps has been updated with public transport planning, although its recommendations aren't necessarily to be taken on trust: it suggested I wait 20 minutes for a bus to a Tube station that's only a nine-minute walk away. iOS's

ABOVE The new Slide Over and Split View modes add a new dimension to iOS

long-neglected Notes app also gets a boost, with sketching tools and capabilities for embedding checklists, maps, URLs and photos. You can even add attachments from other apps, via iOS's Share infrastructure.

Finally, there's a host of small changes. The letters on the keyboard finally change case dynamically when you press the Shift key. In the Photos app, you can now select multiple images by dragging, rather than

"iOS 9 also introduces a more 'proactive' Siri, which attempts to offer information before you ask for it"

having to tap each one individually. If you launch an app from a pop-up notification or Spotlight search results, you'll get a handy "Back to" link in the top-left corner that returns you to where you were before.

It's also now possible to search the Settings menu by keyword, so you no longer need to hunt around. And if you look really hard, you'll see iOS has switched to the San Francisco font introduced with the Apple Watch. The difference is subtle, but the result is a slightly more spacious look.

The public release of iOS 9 is promised for this autumn, which probably means September. Before then it would be nice to see Split View and Slide Over become more versatile, and we hope the new transit functions get smarter too.

Overall, though, it's a case of so far, so good. Although many of iOS 9's new features have been seen before on other platforms, it's an unequivocally positive update. It's packed with improvements, and Apple's focus on boosting power and storage efficiency means that existing iPad and iPhone owners have much to gain from the update. **JONATHAN BRAY**



LEFT The Spotlight search screen gains "Siri Suggestions" and links to nearby places and amenities



Garmin Vivoactive

Long battery life, integrated GPS and ANT+ compatibility make for a great fitness watch

SCORE ★★★★★

PRICE £143 (£171 inc VAT) from [amazon.co.uk](http://amazon.co.uk/pcpro.link/251garmin) (pcpro.link/251garmin)

The Vivoactive is Garmin's attempt to create a mass-market, do-it-all fitness wearable. It offers both basic smartwatch functions and activity- and exercise-tracking features.

It's not exactly stylish, but at only 36g, it's 18g lighter than the Basis Peak – and thanks to the comfortable rubber strap, it's easy to forget you're wearing it. Another strength is battery life: thanks partly to its transfective screen, which remains legible even when the backlight is off, a single charge saw me through more than five days of active use, including regular GPS tracking.

At £171, the Vivoactive is around the same price as the Basis Peak and the Microsoft Band, but it's a much simpler affair. You get GPS and an accelerometer for step tracking, and it's water-resistant to 50m. But as far as built-in features go, that's it.

However, in addition to Bluetooth LE, the Vivoactive also supports ANT+, which means it can connect to dedicated exercise sensors such as heart-rate chest straps and cycling speedometers. If you're serious about exercise, this is great news: the optical heart-rate sensors found on most smartwatches are nowhere near as accurate as a £20 ANT+ strap. And for runners and cyclists, the option to track cadence information is a major plus.

Using the Vivoactive is straightforward. Your steps and sleep are both tracked automatically, with manually activated modes for running, cycling, swimming, golf and walking. Starting an activity is a simple case of bringing up the app list, selecting the desired activity and hitting the Action button.

You're then faced with a scrollable list of information, such as speed, pace and time elapsed. Thankfully, there's no need to physically scroll – that would be tricky while running

or cycling. Instead, tapping the screen flicks through all the available data fields page by page.

The display is highly customisable: you can rearrange the data fields in activity screens and replace existing fields with the data you want. This is fiddly, but you don't have to do it regularly. And if you log on to Garmin's Connect IQ app store, you can download alternative views that squeeze more data onto a single page.

When it comes to uploading your data, Garmin's Connect app is the hub for tracking all your activities. It's available for both Android and iOS, and your data is uploaded into the cloud, so you can keep track of your achievements from any browser. You can also link up your Garmin Connect account to Strava and have your runs and rides imported automatically.

In addition to exercise tracking, the Vivoactive conveys text messages, emails and social-media updates to your wrist with a buzz of haptic feedback. There isn't much granularity to this: you can only choose to receive all notifications or none, although you can choose different settings for rest and exercise. Also note that the 1.4in, 205 x 148 colour LCD doesn't offer a huge amount of space to display texts and emails, and longer emails and texts are cut off, so you need to pull out your phone to read them in full.

There are other shortcomings too: the touchscreen sometimes feels laggy, and sleep tracking is basic, merely producing a graph that shows your movement levels throughout the night. The range of software on Connect IQ is limited compared with more mainstream platforms, although there's always the possibility for that to improve. Given time, and a suitably enthusiastic community to back it up, it could prove a major asset for Garmin.

The Vivoactive doesn't try to be a sleek and sexy do-it-all wearable: it's a GPS-enabled fitness watch with a smattering of semi-smart features. If you're more interested in fitness than fashion, that's almost perfect, and it's comfortable to wear too. Factor in the great battery life and a display that's perfectly suited to outdoor use, and I'm sold. I've tried out numerous fitness wearables, but they've all fallen short. The Vivoactive is the first I'd deem to be worthy of a permanent place on my wrist. **SASHA MULLER**

SPECIFICATIONS

1.4in 205 x 148 transfective colour touchscreen • GPS • Bluetooth LE • ANT+ • water-resistant to 50m • rechargeable Li-ion battery • iOS and Android app compatibility • 1yr RTB warranty • 42 x 8.1 x 50mm (WDH) • 36g



BELOW The Vivoactive uses a transfective screen that helps extend battery life

LEFT You start an exercise session by simply tapping the relevant icon

- Strong battery life, works with professional-grade fitness-tracking sensors
- Limited built-in features, slightly clunky software

XYZprinting da Vinci Jr

There's more to this 3D printer than an arresting price: the da Vinci Jr has a real low-tech charm

SCORE ★★★★★

PRICE £249 (£299 inc VAT) from amazon.co.uk (pcpro.link/251davinci)

At a whisker under £300, the da Vinci Jr is comfortably the cheapest 3D printer we've ever seen. Surprisingly, it doesn't look it. While the likes of Velleman's £400 K8200 printer are built on rudimentary frames, the da Vinci Jr is a solid-looking enclosure in thick moulded plastic. It even sports a four-line LCD screen and control panel on the front.

Part of the price saving is probably down to its compact design: the Jr measures a relatively desk-friendly 43cm on its longest edge, with a maximum print volume of 15cm³.

But the real savings come from simplified internals. The extrusion head is specified only for PLA, not the more brittle ABS, and rather than having its own feeder for the filament, plastic is pushed into it by a separate motor inside the casing, through a tube that loops out of the top.

The boldest omission, without a doubt, is the heated print platform. Normally, 3D printers keep the print bed hot throughout the process, to ensure that your model doesn't contract and deform as it cools. Delightfully, the da Vinci Jr instead comes with several large squares of masking tape, which you stick onto the glass print bed to produce a rough surface for your model to stick to.

The nozzle cleaning procedure is similarly low-tech, requiring you to poke a narrow piece of metal up into the extruder to dislodge any wayward bits of plastic. And while XYZprinting doesn't publish details of the da Vinci Jr's internals, it appears to be very low on internal RAM too: the first time we tried to send it a model, it refused to print until we inserted a 4GB SD card into its internal slot.

None of this immediately rules the da Vinci Jr out of contention. Indeed, as we started setting up our first print, impressions were positive. The XYZware printing client is basic, but it gives you a clear 3D overview of the models you import, and lets you scale and rotate your print job as desired. As usual, support material can be added automatically, and you can optionally

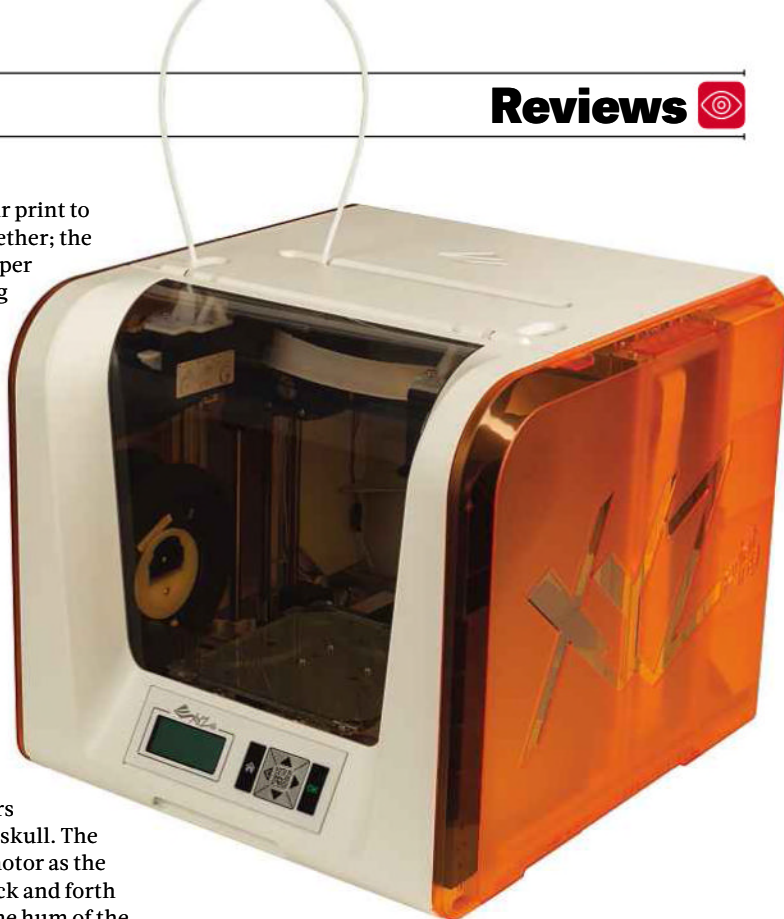
add a raft or a brim to your print to help keep everything together; the printer comes with a scraper and wire brush for tidying up your model once it's complete.

The printing process is slow, but not conspicuously more so than with other 3D printers we've tried. The extruder nozzle measures 0.4mm in diameter, but you can set the print resolution from 0.1mm to 0.4mm, to balance precision against speed: at the standard 0.2mm setting we found it took around 40 minutes to print a Lego brick, and approximately eight hours to produce a small model skull. The whirring of the stepper motor as the extrusion head moves back and forth is all but inaudible over the hum of the small integrated fan; hands down, this is the quietest 3D printer we've tested.

Inevitably, we didn't get to the end of our tests without a few hitches. At first, the plastic didn't set properly on the bed. We deduced that the nozzle was at the wrong height – something we had to correct manually through trial and error, stepping it up and down in 0.05mm increments and firing off test prints until we'd found a setting that worked. If this needs to be done only once then fair enough, but if the height drifts over time this will become tiresome.

Once we'd found a successful nozzle-height setting, things went more smoothly: small models stuck cleanly to the masking-tape bed, making us wonder why anyone ever thought a heated platform was necessary. Unfortunately, larger models detached from the base once they grew beyond around 5cm in height. Since it can easily take around five hours, and a quarter of a spool of filament, to reach this point, this was frustrating indeed. We found a light coating of Pritt Stick on the base helped keep the model anchored, but – as is common with 3D printing – tall models still proved liable to collapse during printing if not assisted by plenty of support material.

The items that we did manage to produce were of quite respectable quality. The tops and bottoms of our Lego bricks were clean enough to fit together – not something one can



ABOVE Despite the low price, the da Vinci Jr looks like a proper consumer appliance

✚ A highly capable 3D printer for a steal
✚ Slow and wayward, like all such devices

BELOW Print quality isn't bad, but larger models didn't always complete successfully



take for granted with this technology – while flat surfaces were regular and gapless. The undersides had a tendency to curl up away from the platform, and vertical detail is a challenge for any 3D printer, but we've seen worse results from far more expensive hardware.

There's one catch that must be mentioned: the da Vinci Jr takes proprietary filament spools, with a chip that tells the printer when the reel has run out. This means you can't feed it generic PLA at around £20 per kilogram: you have to buy da Vinci-branded spools at £30 for 600g. That's a real swizz, since there's nothing at all special about the plastic itself, but considering the upfront price of the printer, it's not too difficult to suck up.

Will the da Vinci Jr finally bring 3D printing to the mass market? Not a chance. Like every 3D printer we've seen so far, it's quirky, unreliable and nowhere near the quality of industrial injection-moulding. It's also limited in terms of material and print size.

For the curious tinkerer who hasn't already taken the plunge, however, the da Vinci Jr really could be a watershed device. With its comparatively desk-friendly design, quiet operation and unbeatable price, it's hard to resist. **DARIEN GRAHAM-SMITH**

SPECIFICATIONS

0.4mm extruder head • 0.1mm print resolution • supports PLA only • USB 2 • microSD slot • 2.6in four-line LCD panel • build volume: 150 x 150 x 150mm (WDH) • external dimensions: 420 x 430 x 380mm (WDH) • 15kg • 1yr RTB warranty





LAPTOPS *of* DESIRE

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From the sleek Asus Zenbook to the powerful Apple MacBook Pro, the laptops here offer the ultimate in design and desirability

The luxurious laptops in this month's Labs are the finest portables money can buy. All are stylish and capable – but within this elite group there's a variety of processors, storage options, display technologies and other variables. Here's our guide to what gives each of these laptops its unique character, and how to decide which will work best for you.

■ Processors and graphics

Five of the six laptops on test stick with Intel's tried-and-tested Core i5 and i7 processors. One, however, opts for Intel's low-power Core M design. It's intended specifically for ultra-thin devices, and no laptop comes thinner than Apple's 12in MacBook.

Built on a 14nm process, the tiny Core M is designed to run cool, removing the need for an internal fan. That means the MacBook is the only laptop here that runs silent, no matter how hard it's being pushed. However, it also means Intel has had to rein back the clock speed to prevent tablets and laptops from overheating. The Core M-5Y31 inside the MacBook is nominally a 900MHz part, and how long has it been since we talked about laptop processors in terms of megahertz, rather than gigahertz?

To speed things up, Apple has boosted the processor's core clock speed to 1.1GHz, but that still leaves it lagging behind the Core i5 processors, as is reflected in our benchmarks. And achieving that higher speed has meant



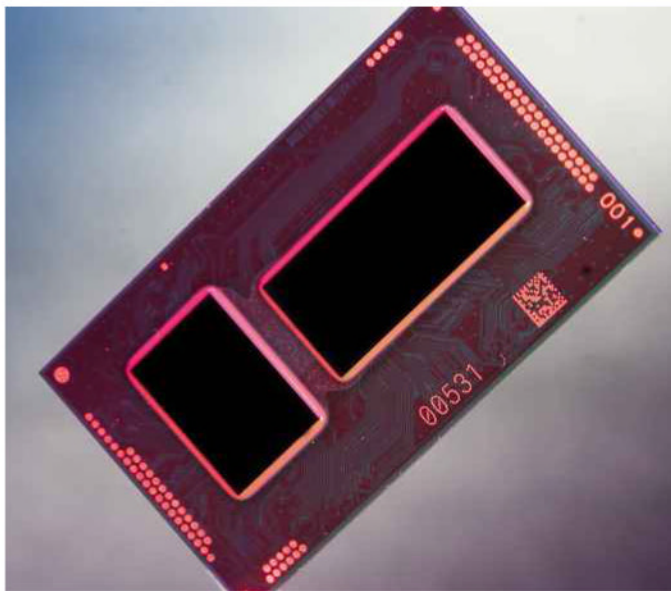
raising the processor's TDP from 4.5W to 5W. While we suspect the impact on battery life is slight, the MacBook does have the joint worst score in our battery-life tests. Even though Apple has sliced its batteries into thin layers to ensure that every cubic centimetre of space inside that tiny shell is filled with power, the MacBook will still require a charge before the end of the day if it's pushed even moderately hard – more on this later.

Although the rest of our laptops all use Core i5 and i7 processors, they don't all hail from the same generation. The Core i5-4300U inside the Surface Pro 3 is from the 22nm Haswell generation, launched in 2013, and uses the older HD Graphics 4400. The rest of the laptops use the more modern 14nm Broadwell architecture and the latest HD Graphics – with the exception of the MacBook Pro, which features the superior Iris 6100 graphics processor. That enhanced chipset is one of the main reasons why the MacBook Pro surges ahead of the Windows pack in our benchmark tests. Where the HD Graphics 5500 offers 24 execution units, capable of 364.8 GFLOPS, the Iris Graphics 6100 has double the number of execution units, running at slightly higher frequency and delivering 844.8 GFLOPS.

■ Displays

One of the reasons Apple has chosen the Iris processor for the MacBook Pro is that it has to push around more pixels than any other laptop in the group. The 2,560 x 1,600 resolution of the MacBook Pro's screen equates to 227ppi – a pixel density that only its 12in MacBook sibling matches. (The fact that the MacBook has to use less powerful HD Graphics 5300 to drive such a high-resolution display is another reason it does so poorly in our benchmarks.)

There's simply no doubt that OS X handles these ultra-high-resolution displays better than Windows. Everything on one of Apple's Retina displays is perfectly scaled for the screen size, so that menu text never becomes unreadable or blurry. Although Windows' handling of high-resolution screens has improved, it's still far from perfect. With default settings, the text in Explorer windows on the 2,160 x 1,440 Surface Pro 3, or the 2,560 x 1,440 Lenovo ThinkPad X1 Carbon, is tiny, almost forcing us to squint at the screen. Open a PowerShell window on either device if you want a real eye test: it's worse



ABOVE Intel's Core M processor focuses on battery longevity, not performance

than the bottom row of an optician's chart. There are workarounds, but you shouldn't have to rely on them.

It's also interesting to see how laptop manufacturers still regard touchscreens as an optional extra rather than a must-have, even at this upper end of the market. Apple is famously averse to the idea of bringing touch controls to OS X, but Asus also spurns a touchscreen on its Zenbook, while the Dell XPS 13 and ThinkPad X1 Carbon offer touch only as an optional extra. Intel's Ultrabook specification stipulates that laptops must have touchscreens, so evidently laptop manufacturers have a lesser regard for that branding than they did a few years ago (*see opposite*).

We still believe that a laptop intended to run Windows 8.1 – or soon Windows 10 – is generally enhanced by a touchscreen, not least because many of the apps

(particularly games) in the Windows Store are designed for touch controls. But touch does have downsides. The touchscreen layer on the ThinkPad's 14in screen, for example, creates a visible mottling effect, which softens the appearance of its MacBook-rivalling resolution.

■ Ports and connections

Another major point of differentiation between these laptops is the number of ports and connections they offer. At the minimalist end of the scale, the MacBook has only one port: the new, reversible USB Type-C connector that's used for everything from charging the laptop to connecting external displays and storage. With only a single port, you're going to need adapters to do more than one of these tasks simultaneously, which for us crosses the tipping point of form over function. The one notable advantage of USB Type-C on a laptop is compatibility with portable power supplies, which could help the MacBook keep going for the duration of a transatlantic flight, for example.

The Surface Pro 3, meanwhile, betrays the fact it's a tablet by providing only a mini-DisplayPort and a single USB 3 socket, in addition to its power connector – and even that single port is incapable of powering some external hard drives. The conventional laptops offer more ports, none more so than the MacBook Pro, which offers two different types of display output, two Thunderbolt 2 and two USB 3 ports.

Ethernet ports have been expunged from all of our laptops, but for those who need the stability of a wired connection, both the Asus and the ThinkPad come with adapters in the box. You'll have to buy USB adapters separately for the rest.

How we test

All six of the laptops in this month's Labs are put through a comprehensive series of tests. Our new benchmark suite measures the performance of each laptop across three different types of workload: image editing, video editing and multitasking. These push the laptops' CPU and memory to full utilisation for sustained periods of time, ensuring you get a true reflection of the capabilities of these machines.

The laptops are scored against our reference machine – a desktop PC with an Intel Core i5-4670K CPU, 8GB of RAM and an AMD Radeon R7 260X graphics card, which gets a score of 100. So a laptop with a score of 50 is half as fast as our reference PC. The two Macs were

benchmarked using Windows 8.1 on a Boot Camp partition.

We also test the quality of the display, using an X-Rite iDisplay 2 colorimeter. We measure the maximum brightness, contrast ratio and colour accuracy of each screen, as well as drawing on our own impressions of the screen quality.

Finally, we measure the battery life of each of the laptops. We do this by setting the brightness of the screen to 120cd/m² (measured using the colorimeter) and playing a 720p video on loop using the laptop's default video application. All wireless connections are switched off while the test is running. Our battery-life scores thus provide a realistic best-case scenario.

Has the Ultrabook had its day?

Intel's Ultrabook initiative saw mobile computers become thinner and lighter – but other firms are now offering the same for less money. So what's next?

When Intel unveiled the Ultrabook concept in 2011, Windows laptop design was in a sorry state. The original MacBook Air had been launched three years previously, but PC manufacturers were still struggling to deliver an ultraportable with even a fraction of its desirability.

So Intel decided that something had to be done. Through Intel Capital, its investment arm, it launched a \$300 million (£192 million) fund to promote the creation of a new, sleeker generation of laptops. "The Ultrabook Fund will focus on investing in companies building technologies that will help revolutionise the computing experience and morph today's mobile computers into the next must-have device," said Arvind Sodhani, president of Intel Capital, at the time.

Intel also teamed up with leading PC manufacturers to create the Ultrabook specification. Only laptops less than 21mm thick (or 18mm for 13.3in screens), with a battery life in excess of five hours, would qualify. Oh, and they needed to use Intel Core processors, of course. Machines that met the criteria would use the Ultrabook logo and benefit from Intel's marketing push, rewarding the manufacturers for their efforts.

The initiative has had an undeniable effect over the past four years. Although the MacBook Pro is this month's Labs winner, its Windows rivals no longer look like ugly ducklings. Hide the Dell logo on the XPS 13 and you might even fool people into thinking it's a MacBook. Industry watchers agree that the initiative has given the market a shot in the arm: "Intel played a very important role in making the redesign of the laptop happen, and the eventual revival of PC sales," Maciej Gornicki, research manager at IDC, told *PC Pro*.

Yet here's the odd thing. The Dell XPS 13 doesn't bear the Ultrabook logo. Nor does the equally eye-catching Asus Zenbook. In fact, only two of our six devices this month come with that once-cherished sticker. What's happened to the Ultrabook name? Does it still mean anything?

■ Today's Ultrabook spec

Since its launch, the Ultrabook specification has been through two major revisions, most recently in 2013. Today, an Ultrabook must be 20mm or thinner if its display is smaller than 14in, or less than 23mm thick if it has a bigger screen. More interestingly, that display must also be a touchscreen, leading to a situation where some models within a laptop range are Ultrabooks and some aren't. For example, the Dell XPS 13 on test doesn't meet the criteria, but the touchscreen variant – which looks outwardly identical – does.

Intel also uses the Ultrabook specification to push certain technologies, and not only its Core processors. All modern Ultrabooks must support the company's WiDi protocol, for example, which allows you to wirelessly beam video from your laptop to compatible television screens or projectors. If that's missing, there's no sticker for you.

■ Where now for Ultrabooks?

Four years on, the Ultrabook initiative has arguably done its job. "Although Ultrabooks initially were offered at very high price points (and a majority of them still are), their introduction

led to an overhaul of the majority of portable PC designs in the market, irrespective of their tech specs," said IDC's Gornicki. "Even though an Ultrabook is quite pricey these days, many vendors offer less expensive models, with less power inside, which are still very light and attractive for the average consumer to buy."

The analyst also claims that the Ultrabook sticker does little for sales. "I think that in the majority of cases, consumer's purchasing decisions are not influenced so much by whether a portable PC is actually branded an Ultrabook or not," he said. "There are more important factors such as price or performance that influence consumer behaviour."

Meanwhile, Intel has seemingly shifted its focus onto laptops that can be converted into tablets, such as the Microsoft Surface Pro 3, which carries the Ultrabook sticker.

"I'm not entirely sure where Intel will go with its Ultrabook campaign in the future," said Gornicki. "The company did a great job in transforming the industry to offer much thinner and lighter machines. But my impression is that for the past two years Intel has been focusing more on promoting two-in-one designs, which is yet another step on the road to transforming a laptop into a more attractive and useful product. It's already become slim; now it's time to bring more versatility, by offering a rotating or detachable touch-enabled screen."

On the schedule for the Intel Developer Forum held in Shenzhen in April, you'll see not a single session devoted to Ultrabooks – but there is one entitled "Design considerations and reference designs for value and mainstream two-in-ones". The accompanying presentation perhaps gives a clue as to why Intel has shifted its focus: "Two-in-one buyers refresh their PC approximately one year earlier than notebook buyers," it reveals.

With the overall PC market continuing to shrink, Intel is perhaps banking on convertible devices to give the market a fresh shot of adrenaline, just as the Ultrabook did four years ago.



ABOVE Intel's brand is no longer a must-have for a lightweight laptop



	LABS WINNER	RECOMMENDED				
Overall	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Purchase information						
Part code	MF856B/A	MF839B/A	90NB04Y1-M05000	XPS13 (9343)	20BSCT01WW	MQ2-00001
Price (inc VAT)	£874 (£1,049)	£832 (£999)	£583 (£699)	£791 (£949)	£1,608 (£1,929)	£708 (£849)
Delivery ¹	Free	Free	Free	Free	Free	Free
Supplier	apple.com/uk	apple.com/uk	currys.co.uk	dell.co.uk	lenovo.com/uk	microsoftstore.com
Dimensions (W/D/H, including feet)	281 x 197 x 13mm	314 x 219 x 18mm	322 x 223 x 21mm	304 x 200 x 15mm	331 x 227 x 19mm	292 x 201 x 9mm
Weight (with charger)	0.92kg (11kg)	1.58kg (1.82kg)	1.4kg (1.7kg)	1.18kg (1.46kg)	1.31kg (1.67kg)	0.8kg (0.97kg)
Service & support						
Warranty ²	1yr-RTB	1yr-RTB	1yr-RTB	1yr-RTB	3yr-on-site	1yr-RTB
Manufacturer reliability/support score ³	93% / 90%	93% / 90%	85% / 78%	83% / 77%	84% / 75%	N/A
Core components (as reviewed)						
Processor	1.1GHz Intel Core M-5Y31	2.7GHz Intel Core i5-5257U	2.4GHz Intel Core i7-5500U	2.2GHz Intel Core i5-5200U	2.6GHz Intel Core i7-5600U	1.9GHz Intel Core i5-4300U
RAM fitted	8GB	8GB	6GB	8GB	8GB	4GB
Display						
Size & finish	12in gloss	13.3in gloss	13.3in semi-matte	13.3in matte	14in gloss	12in gloss
Resolution	2,304 x 1,440	2,560 x 1,600	1,920 x 1,080	1,920 x 1,080	2,560 x 1,440	2,160 x 1,440
Touchscreen (type)	✗	✗	✗	✗	✓ (10-point)	✓ (10-point)
Graphics chipset	Intel HD Graphics 5300	Intel Iris Graphics 6100	Intel HD Graphics 5500	Intel HD Graphics 5500	Intel HD Graphics 5500	Intel HD Graphics 4400
Video outputs	via USB Type-C adapter (not included)	HDMI; mini-DisplayPort	HDMI; mini-DisplayPort	mini-DisplayPort	HDMI; mini-DisplayPort	mini-DisplayPort
Drives						
Storage capacity (as reviewed)	256GB	128GB	128GB	256GB	256GB	128GB
Storage type	SSD	SSD	SSD	SSD	SSD	SSD
Optical drive	✗	✗	✗	✗	✗	✗
Battery						
Battery type (capacity)	Lithium-polymer (39.7Wh)	Lithium-polymer (74.9Wh)	Lithium-polymer (50Wh)	Lithium-ion (52Wh)	Lithium-polymer (50Wh)	Lithium-ion (42Wh)
Ports & connections						
Wireless connectivity	802.11ac; Bluetooth 4	802.11ac; Bluetooth 4	802.11ac; Bluetooth 4	802.11ac; Bluetooth 4	802.11ac; Bluetooth 4	802.11n; Bluetooth 4
Wired Ethernet speed (Mbps/sec)	N/A	N/A	(10/100 adapter in box)	N/A	(10/100 adapter in box)	N/A
Memory card reader	✗	SD/SDHC/SDXC	SD/SDHC/SDXC	SD/SDHC/SDXC	✗	SD/SDHC/SDXC
Ports	3.5mm headphone jack; USB Type-C	3.5mm headphone jack; 2 x Thunderbolt 2; 2 x USB 3	3.5mm headphone jack; 3 x USB 3	3.5mm headphone jack; 2 x USB 3	3.5mm headphone jack; Ethernet adapter port; 2 x USB 3	3.5mm headphone jack; USB 3
Other features						
Webcam	480p	720p	720p	720p	720p	1080p (front and rear)
Backlit keyboard	✓	✓	✓	✓	✓	✓
Touchpad toggle on/off	✗	✗	✗	✗	✗	✗
Volume control	✗	✗	✗	✗	✗	✓



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Apple MacBook Pro 13in with Retina display

A near-perfect balance of portability and power, with a stunning screen and an updated trackpad to boot

SCORE ★★★★★

PRICE £832 (£999 inc VAT) from [apple.com/uk \(pcpro.link/251mbpro\)](https://apple.com/uk/pcpro.link/251mbpro)

The MacBook Pro is a familiar design: it hasn't received a significant makeover for a few generations, but it still strikes the right balance between practicality and poise. The 13in model is heavier

than most laptops here, and that's compounded by a chunkier charger. But you get plenty for your money.

For a start, it's exceptionally comfortable to work on. A MacBook Pro on your lap feels like a deceptively expansive workspace; even at a desk, it feels generous, rarely leaving us tempted to plug in an external screen.

That's partly down to the vast 2,560 x 1,600 resolution of the built-in panel – and OS X's clever graphics technology, which scales applications for a high-DPI screen considerably better than Windows. Another reason we're happy to forgo the external display is that you'll struggle to find one as sumptuous as the Pro's built-in panel. When you're sitting next to a bright window, the 400cd/m² maximum brightness ensures details are perfectly visible, even though it's more reflective than the screen on the Dell XPS 13. The

ABOVE The MacBook Pro sticks with the design formula of previous models



97.7% coverage of the sRGB colour gamut and near-flawless colour accuracy will delight filmmakers and photographers, and contrast is stark at 994:1. If there's a better laptop screen out there, we're yet to see it.

Looks aren't everything, of course, but the Pro isn't found wanting for connectivity or power either. With mini-DisplayPort (in the form of Thunderbolt) and full-sized HDMI outputs, you're not short of options for connecting external displays. The Intel Iris graphics can easily handle full native resolution – as well as two external displays running at up to 3,840 x 2,160, which is surely more pixels than anyone could need.

Two USB 3 connections and the aforementioned Thunderbolt 2 sockets also provide ample options for connecting high-speed external storage – which is just as well, since the base model comes with only 128GB



1 The MacBook Pro's design has barely changed in several years, but its simplicity still looks fresh

2 & 3 A generous set of ports ensures you can hook up to external storage and displays with ease

4 The new Force Touch trackpad adds a new way to interact with the OS and applications

of PCI Express-based flash. The step up to a 256GB model adds £200 to the price, but is the least that you should consider if you plan to split the storage with a Windows Boot Camp partition.

Unlike the 12in MacBook (see p88), the Pro doesn't offer the new Type-C USB connector, instead using Apple's regular MagSafe connector to charge. That's fine, not least because the connector has a handy indicator light on the top of it, letting you know the charger's plugged in properly. An LED battery indicator like the Dell XPS 13's would have been better, but with the MacBook Pro lasting 9hrs 40mins in our video-rundown test, you won't be concerned about running out of battery until pub time.

When it comes to processing power, the MacBook Pro is right up there with the best. Its overall benchmark score of 56 was head and shoulders above every other

contender this month. The Core i5 processor and Iris GPU particularly told in the video-editing test, which the MacBook Pro completed in less than half the time it took the Core M-equipped MacBook.

The Pro is also a strong multitasker; its performance edge can be seen with the naked eye. Applications open just as quickly as OS X's animations can carry them, 4K video footage plays without stutter, and you can keep a whole dock-full of apps running without unduly burdening the 8GB of RAM at your disposal.

That's not to say the MacBook Pro is flawless. It split the office, but some of us prefer the bigger, shallower keys on the new MacBook's keyboard to the well-spaced ones on the MacBook Pro. Music sounds slightly tinnier from the Pro's speakers than it does from the MacBook's, even though it has a larger casing in which to house them.

"Looks aren't everything, but the MacBook Pro isn't left wanting for either connectivity or power"

But this is nitpicking. The 13in MacBook Pro is a fabulous laptop that puts its Windows rivals to shame. The touchpad controls alone make the competition seem clunky; you can glide smoothly through web pages and flick effortlessly between apps, and this will only improve when developers start taking advantage of the new Force Touch control, which can detect a hard press on the touchpad as distinct from a regular tap, adding a new dimension to the desktop.

Trying to make sense of Apple's pricing is always a fool's errand, but we're baffled as to how the MacBook Pro can cost less than the 12in MacBook. It has a bigger display, better connectivity and far more power. The one thing the MacBook Pro lacks is a touchscreen – but there's still simply nothing to touch it.



Dell XPS 13

A truly exceptional ultraportable, let down only by an uneven and inconsistent screen

SCORE ★★★★★

PRICE £791 (£949 inc VAT) from dell.co.uk
(pcpro.link/251xps13)

The Dell XPS 13 is the closest rival to the MacBook and MacBook Pro in this group. In fact, it's probably the closest Windows-based alternative to a MacBook there is. Although it shares the same nominal screen size as the MacBook Pro, it's almost a halfway house between the

two Apple laptops in terms of both performance and size.

We have to applaud Dell's attention to detail in the design of the XPS 13. Its aluminium casing is virtually indistinguishable from the MacBook's, giving this dinky laptop a reassuringly solid feel. Look more closely and thoughtful design touches can be found all over. On the left-hand flank there's a discreet five-LED battery indicator, allowing you to press a button and check how much juice remains without firing up the laptop. This is handy, since both of the Dell's USB 3 ports support PowerShare, allowing you to charge a smartphone or other USB device even when in standby. The power cord also has an LED indicator, providing instant reassurance that it's plugged in properly, and the Dell uses one of the dinkiest power bricks we've ever seen – it's roughly the size of a deck of

ABOVE The XPS 13 takes design cues from the MacBook



cards. The only thing we don't like about the exterior is a daft little flap on the underside, which hides the serial number and safety information. We snagged it on our trousers when using the XPS on our lap, and we can see it snapping off down the line.

Flip open the laptop and the design excellence continues inside. The palm rest is made from an attractive chequered carbon-fibre material that's pleasingly smooth to the touch. The trackpad is a decent size and super smooth in operation – the closest any of the Windows touchpads come to matching Apple's. And although the keyboard is a tad rattly for our liking, it's by no means a weak spot.

Then we come to the XPS 13's most divisive feature: its screen. With its ultra-thin bezel and matte finish, the display has an almost paper-like quality to it. It's offered in both Full HD, as reviewed here,



1 Dell's aluminium casing is understated but elegant – and tough

2 & 3 At the sides, a “sandwich” design exposes all the important ports

4 The touchpad is the best we've seen on Windows

and in a Quad HD+ 3,200 x 1,800 model. Even at the lower resolution it looks stunning.

Sadly, it's let down by two huge flaws. When we reviewed the ultra-high-resolution model earlier this year, the experience was marred by visible backlight bleed, and that's also apparent on this Full HD model, particularly in the bottom-left corner. Worse, Dell has deployed a dynamic-contrast system that boosts the screen's brightness when there's light content onscreen, and dials it back when the screen is dark. It's highly noticeable when you flick from a dark Windows Start screen to a Word document, as the display takes a second or two to adjust to peak brightness. Since you can't switch off this feature, the XPS 13 is useless for anything colour-critical, as you simply have no control over the display. Now that the XPS 13 has

been on sale for a few months, we'd hoped Dell would have offered a workaround, but no joy.

The XPS 13 doesn't disappoint when it comes to performance, however. Even though our review model is the second-lowest spec that Dell offers, its 2.2GHz Intel Core i5-5200U and 8GB of RAM powered it to an overall benchmark score of 39, making it almost twice as fast as the 12in MacBook and a third faster than the Surface Pro. It still trails the MacBook Pro by a significant margin, but everything on this little laptop feels suitably snappy. The XPS 13 chewed through demanding Windows Store games such as Asphalt 8, and although the fans do kick in after a couple of minutes of 3D action, they never reach irritating noise levels.

If that fan noise does become a distraction, you'll be able to drown it out with the surprisingly powerful

speakers, which don't distort even with the volume cranked all the way to 100 (although music lacks almost any trace of bass). Battery life is exceptional, too: the XPS 13 lasted 10hrs 23mins in our video-rundown test, which is 43 minutes longer than the MacBook Pro.

Overall, the XPS 13 is one of the most alluring Windows ultraportables we've ever seen. It's a real shame that Dell's baffling decision to impose dynamic contrast rules it out as an option for photographers, or anyone

who needs fine control over colours. All the same, it's unlikely to ruin the laptop for most. Only the marginally more expensive MacBook Pro stops the Dell XPS 13 running away with this month's Labs Winner award, and that's by no means damning with faint praise.

“With its ultra-thin bezel and matte finish, the display has an almost paper-like quality to it”



Apple MacBook

A hugely desirable design – but too many shortcomings mean this isn't the best option even for Apple fans

SCORE ★★★★★

PRICE £874 (£1,049 inc VAT) from apple.com/uk (pcpro.link/251macbook)

Apple ditched the suffixes when it launched the 12in MacBook – but if you want to trace its pedigree, it's a laptop that's much closer to the Air than the Pro, in terms of both performance and panache.

Without question, the MacBook is the laptop we'd want on a business trip. It's light, at 0.92kg, and perfectly proportioned. Most compact laptops are tough to type on, but the MacBook's backlit keyboard is a delight: well spaced, with just enough travel beneath the keys; our only gripe is the half-sized Enter key.

The trackpad is great, too. It's huge in comparison to the rest of the laptop, roughly the size of a compact smartphone, yet it responds to every glide of the finger with precision and doesn't get in the way. It's also pressure-sensitive, allowing you to push down firmly to register a Force-click – a third option beyond the conventional left- and right-clicks. Right now, that delivers little

ABOVE Perfect for business trips, the MacBook is compact and lightweight



ABOVE Connectivity is limited to a single USB Type-C connector

more than Wikipedia definitions of words Force-clicked in Safari, but we can't wait for other applications to exploit this option.

The one regard in which the MacBook is more Pro than the Air is its screen. The 2,304 x 1,440 Retina display is astoundingly sharp, and both our eyes and measurements tell us it's among the best here. Its colour temperature of 6,683K is only slightly away from perfection, and with 93% of the sRGB colour gamut covered, it's plenty good enough for professional photo jobs. The black bezel running around the edge is conspicuous only next to the almost-edgeless Dell XPS.

What's much more noticeable is the MacBook's lack of ports: everything has to be plugged into the same single USB Type-C connector that's used to charge the laptop. Apple, of course, sees this as a design

feature; we see it as a compromise too far. Without a hub or adapter to hand, you can't pop as much as a memory card into the laptop, and adding one makes things more awkward – and expensive. Apple wants £65 for its USB-C Digital AV Multiport Adapter to drive an external screen, for example, although this also provides one additional standard USB socket.

The MacBook lacks raw power too. While the 1.1GHz Core M processor and 8GB of memory keep OS X ticking over flawlessly, this isn't a laptop that's going to churn through a batch of raw images or scream through edits in Final Cut Pro. An overall score of 20 in our new benchmarks confirms the MacBook as the worst performer on test by a distance, and you won't be able to run demanding games at anywhere near native resolution – at least, not at acceptable frame rates.

That lack of grunt does have its upsides. You'll never hear a whirr or hum from the MacBook, because the chassis is entirely fanless, and even when you're pushing the MacBook it doesn't get unreasonably hot. It came joint bottom in our video-rundown battery test, lasting 7hrs 10mins, but this isn't at all bad or surprising considering the limited size of chassis. It might just get you through a transatlantic flight.

And that, ultimately, is what the MacBook is for: it's the finest executive toy ever invented. Arguably, it's even the most desirable laptop on test this month – but it's also the most impractical. If you need a laptop for web browsing and punching words onto a screen, the MacBook is simply magnificent. For more demanding work, its award-winning sibling is by far the better option.



LEFT Keys are well spaced and the touchpad responds with precision



Asus Zenbook UX303LA

A capable laptop at a tempting price, but small disappointments diminish the overall experience

SCORE ★★★★★

PRICE £583 (£699 inc VAT) from currys.co.uk (pcpro.link/251zenbook)

The Zenbook packs in one of the most powerful processors in this month's test – yet it's the cheapest of the lot. It comes with a 2.4GHz Core i7-5500U, which Turbo Boosts to 3GHz, and 6GB of RAM, which helped it land a strong overall benchmark score of 45. That wasn't quite enough to make it a winner in the performance stakes, however: while the Apple MacBook Pro is only kitted out with a Core i5, its extra RAM and faster storage helped it outpace the Asus with a score of 56.

That Core i7 power doesn't have an adverse effect on battery life, thankfully. The Asus looped happily through our 720p video for just seven minutes short of nine hours, leaving it trailing only the MacBook Pro and the diminutive Dell XPS 13.

Graphics-wise, Asus relies on Intel's integrated HD Graphics 5500 GPU, so the Zenbook won't get hardcore gamers' adrenaline pumping. To get Crysis up to a

ABOVE The Zenbook UX303LA lacks the premium look and feel of a truly high-end laptop



ABOVE The Zenbook is well connected, with three USB 3 ports

just-playable 25fps frame rate, we had to drop the resolution to 1,440 x 900 and keep the graphics quality to Medium. Casual gamers should find Intel's integrated GPU powerful enough, though: the Zenbook strolled through Asphalt 8 from the Windows Store, with no tearing or stutter evident throughout gameplay.

The real compromise here is the screen. Although the Zenbook's 13.3in IPS panel is nominally around the same size as the display on the MacBook Pro, it offers a much lower Full HD resolution, which in turn means a much lower pixel density.

That's not to say it's a poor display: a contrast ratio of 925:1 gives images a decent amount of punch, colour accuracy is respectable, and there isn't a hint of the backlight bleed that mars the Dell XPS 13. When you place the Asus next to the MacBook Pro, however, you

can't help but notice that photos don't quite have the same depth of tone or fine detail.

The Zenbook's full metal shell doesn't feel quite as solid we'd like – there's certainly a little give in the lid – but it won't be easily dented, either. The circular brushed-metal design on the lid gives the laptop the appearance of a vinyl LP, which isn't unattractive. It's not exactly upmarket, though; it doesn't quite have that premium look and feel.

The keyboard is well spaced and stays just the right side of rattly. An ambient light sensor automatically adjusts the keyboard's backlight, and the LED indicator cut into the F2 key that tells you when Flight mode is engaged is a nice touch. We had to reinstall the trackpad drivers to get Asus' Smart Gesture system to work properly, however, and even when working as it should, it's nowhere near as smooth as two-fingered scrolling or gesture controls as the MacBooks or the Lenovo ThinkPad.

The speakers are a disappointment, too. An etching beneath the keyboard suggests they're powered by B&O, but the experience is more Olufsen than Bang, with the maximum volume level proving barely sufficient even in a quiet room. At least your chances of accidentally disturbing colleagues are kept to a minimum.

Overall, we're a smidgen short of smitten with the Zenbook. It has plenty of power, it doesn't sacrifice battery life and it's pleasant to use. But the little things – such as that iffy touchpad and lacklustre speakers – betray the budget. If you're looking for a luxury laptop that you can be proud to own and use, we recommend you skip the Zenbook and spring for one that doesn't cut corners with the design.



LEFT An LED indicator cut into the F2 key informs when you're in flight mode



Lenovo ThinkPad X1 Carbon

Dripping with features that professionals will love, but the steep price is hard to justify

SCORE ★★★★★

PRICE £1,608 (£1,929 inc VAT) from lenovo.com/uk (pcpro.link/251x1carbon)

The ThinkPad Carbon is this month's most businesslike laptop, offering enterprise-grade features that even Apple's "Pro"-branded laptop lacks. For one, it's the only laptop here with an integrated 4G adapter, so you won't be left scouting for a Wi-Fi hotspot or faffing with smartphone tethering.

Then there's the fingerprint reader, now tucked to the right of the keyboard rather than on the palm rest as on previous Carbons. Intel's vPro technology lets IT departments remotely secure a stolen laptop, and unlike Apple's highly nickable MacBook Pro, the X1 Carbon comes with a security lock slot, so you can bind it to your desk or a sales stand.

With a top-end Core i7 processor and 8GB of RAM to play with, we had high expectations of the X1 Carbon – but in our benchmarks it achieved only the same overall score as the

ABOVE The full-metal shell means this Carbon won't suffer the scuff marks of previous models



ABOVE A security lock slot ensures the X1 Carbon can be secured to a desk

Asus Zenbook. Evidently thermal throttling holds back the processor during sustained periods of peak load – so save yourself £150 and don't bother with the upgrade from the Core i7-5500U to the i7-5600U.

It was a shame that the ThinkPad's battery ran dry almost two hours sooner than the MacBook Pro's in our video-rundown test – but it was no surprise since its battery is 50Wh, compared to the MacBook's 74.9Wh.

The laptop has a reassuring solidity, yet, despite boasting a bigger screen than both the MacBook Pro and the Asus Zenbook, it's at least 100g lighter than both. The relatively lightweight power brick doesn't add undue bulk. The rubberised lid of previous Carbons was easily scuffed, so we're glad to see a full-metal shell on this third-generation model.

There's little to fault on the inside. The keyboard is well spaced, with

plenty of cushioned travel under each of the keys and a lovely big Enter key. Slap bang between the G, H and B keys you'll find the trademark Lenovo TrackPoint – but those who prefer the touchpad will find it flawless, with a delicate clunk to confirm that a click has been registered. While it's not as sizeable as the MacBook Pro's touchpad, there's not a great deal in it.

It's also less of an issue, because this high-end variant of the X1 comes with a Quad HD touchscreen. It works perfectly – flicking through the Start screen or a web page is beautifully smooth – but the touchscreen coating visibly mars the display; as with previous Carbons, the screen looks like it's been sprayed with a fine mist, almost as if you're looking through a sheet of cling film.

Colour is another issue. Photos don't look bad in isolation, but they're slightly duller than on either of the MacBooks. The maximum measured brightness of 304 cd/m² is dim in comparison to Apple's displays, and colour accuracy was wayward, with an average Delta E of 2.98. For all those reasons, the X1 Carbon wouldn't be our choice for photography or video work.

The big issue with the X1 Carbon is its staggering price. Features such as 4G, a fingerprint reader and a three-year on-site warranty are significant add-ons that shouldn't be discounted, but when the MacBook Pro offers more power, a vastly better screen and longer battery life for around half the price, we can't endorse spending this much on the ThinkPad. If you're prepared to sacrifice power, screen resolution and the touchscreen, you can buy the entry-level ThinkPad for £1,200 – but in comparison to our Labs winner, that model looks even less alluring.



LEFT The trademark Lenovo TrackPoint works flawlessly



Microsoft Surface Pro 3

By far the best Surface yet, but it doesn't quite cut it as the laptop replacement Microsoft wants it to be

SCORE ★★★★★

PRICE £708 (£849 inc VAT) excluding Type Cover, from microsoftstore.com (pcpro.link/251sp3)

Microsoft touts the Surface Pro 3 as “the tablet that can replace your laptop”, but in terms of raw performance, it falls rather short. An overall benchmark score of 29 represents less than half the performance of the MacBook Pro, even though the two cost more or less the same – once you add the cost of the Touch Cover keyboard to the £849 asking price.

That price gets you a 1.9GHz Intel Core i5 from the Haswell generation, and only 4GB of RAM, which explains why the Surface struggled in our multitasking benchmark. You can step all the way up to a Core i7 with 8GB of RAM and a 256GB SSD, but that will set you back a handsome £1,549.

The Surface Pro 3 is also light on ports: mini-DisplayPort is the only video output, and there's only one USB 3 port to play with. Note that this has a maximum power output of 900mA, which wasn't enough

ABOVE The updated design results in a far better experience in desktop mode



ABOVE With only a mini-DisplayPort and a single USB 3 port, the Surface Pro 3 suffers poor connectivity

juice for one of our USB 3 hard disks. At least there's a spare USB port on the charger for keeping a phone topped up.

Despite its limitations, the Surface Pro 3 is usable as a day-to-day laptop. Previous versions of the Surface have always worked better in tablet mode, but Microsoft has now refined the design considerably, with a kickstand that can be set to virtually any practical angle, to suit a lap or a desk.

The Type Cover – a £109 “option”, which we'd regard as mandatory – is also much improved. It doesn't flex as much as previous models, which helps you work with the device on your lap, and the Touchpad is bigger than on previous models, too, although still tiny in comparison to that of the similarly sized MacBook.

Thankfully, you don't need to rely on the touchpad to scroll through

pages and swipe through apps, because the Surface has a splendid 12in touchscreen. It's not quite as high-resolution as the MacBook's, but when the two devices are placed side by side, it's impossible to spot a tangible difference in detail. Apple's displays also give a slightly warmer image, although here we're talking fine margins. The Surface Pro's measured average Delta E of 1.77 and 96.2% coverage of the sRGB colour gamut tell you there isn't much wrong at all with this display – although the maximum brightness of 325cd/m² is down on both previous Surface Pros and the Labs-winning MacBook Pro.

In tablet mode, the Surface Pro 3 is heavier than the iPad Air, but at 800g it doesn't make your arms ache, and the supplied N-trig stylus delivers the most paper-like writing experience we've encountered on a tablet. For quick notes or sketches, it's sensational. Microsoft's still struggling to find a home for it, though: the stick-on fabric loop for the bottom of the Type Cover is easily knocked off in a bag.

The screen, meanwhile, feels natural in portrait mode, thanks to its 3:2 aspect ratio – a big improvement on the 16:9 of previous Surfaces. And the Surface Pro 3 is much kinder on the battery than its predecessors: set it down overnight and you won't come back to find the charge half gone. That said, it lasted only 7hrs 10mins in our video test, the joint worst score here.

Overall, the Surface Pro 3 is a huge improvement on previous models, but it falls just short of Microsoft's claim: as a laptop it has too many shortcomings for its price. All the same, if you're searching for a lightweight hybrid, it's one of the best we've seen.



LEFT The Type Cover is more solid than previous models, and the touchpad is bigger

View from the Labs

Advances in build quality and higher screen resolutions are welcome, but some upgrades offer little true benefit, warns **Barry Collins**

The first takeaway from this month's Labs is that, these days, if you have £700 or more to spend on a laptop then you're going to get a very decent machine indeed. There isn't a single device here, even the compromised Surface Pro 3, that we wouldn't be very happy to tuck in a laptop bag.

One thing that's notably improved in recent years is build quality. I remember spending upwards of £1,000 on a laptop four or five years ago, only to see port flaps snap off, the casing crack and key tops start to rub off within a year of daily toil. We feel confident that none of the laptops in this test would suffer a similar fate.

Unibody metal casing has become the norm for premium laptops, a welcome trend for which we clearly have Apple to thank. And it hasn't come at the expense of added weight: the aluminium shells on these laptops are as light as – if not lighter than – their plastic ancestors. They'll withstand far more punishment too. We've seen a MacBook Pro dropped off the side of a desk, and while it may have ended up with an unsightly dent, that's far preferable to cracked plastic exposing the components inside. The



Barry Collins is a former editor of **PC Pro**

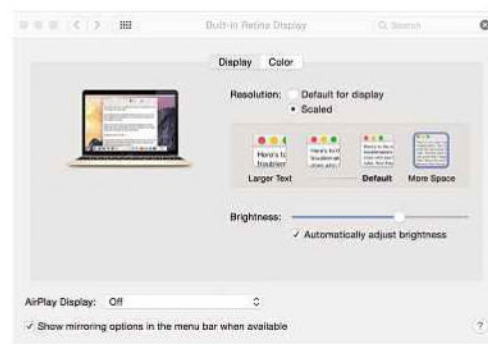
“There isn't a single device featured in this test that we wouldn't be very happy to tuck into a laptop bag”

days of seeing expensive laptops patched up with gaffer tape are coming to an end.

The other big advance has been in screen resolution. A 12in device with a 2,304 x 1,440 screen would have been utterly unthinkable just a few years ago – not only because screens were offering nowhere near 227ppi, but because the integrated graphics processors wouldn't have been able to cope with pushing around that many pixels. So here we have Intel to thank as much as the display manufacturers.

However, there's a sense of diminishing returns with these ultra-high-resolution screens. There's no denying that the displays on the MacBook and MacBook Pro look phenomenal, especially for watching 4K video.

But one of the reasons the Dell XPS 13 offered twice the performance and three hours more battery life than the MacBook is because our review model was

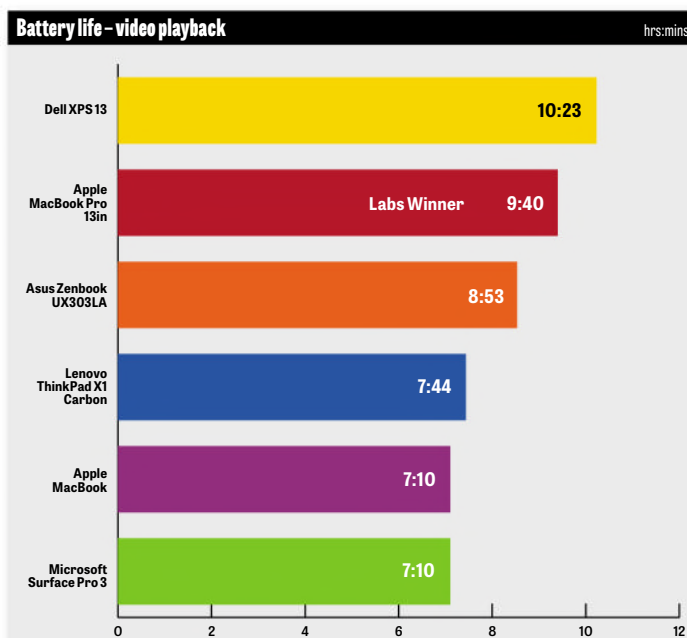
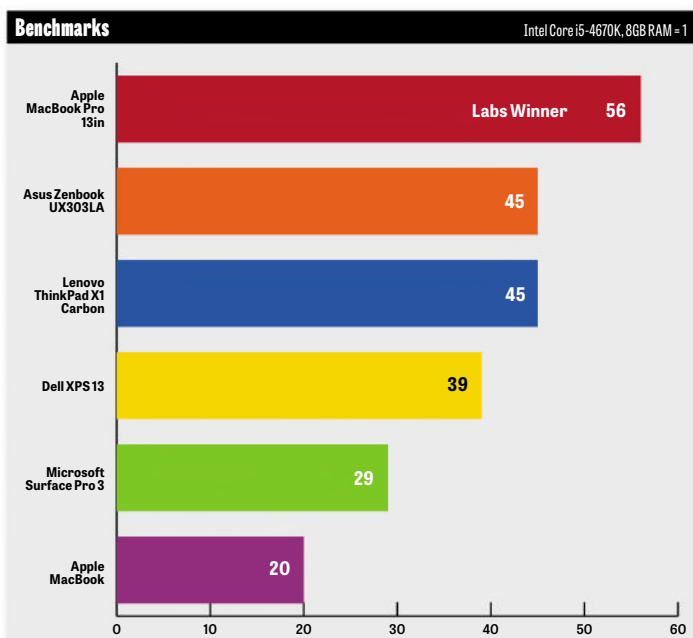


ABOVE Although offering superb quality, will a Retina screen impact too heavily on battery life?

limited to a Full HD screen. Sure, it's not as sharp, but it still offers bags of detail. We'd take the improved performance and battery life over an expensive upgrade to the Quad HD version of the same laptop.

Indeed, our parting shot is to be wary of paying for the upgrades on offer with all of these machines, particularly CPU bumps. As we saw with the ThinkPad, spending £150 on a slightly faster processor can end up making no real-world difference at all. Buy the spec that you need, not the one the manufacturers want you to. ●

Test results





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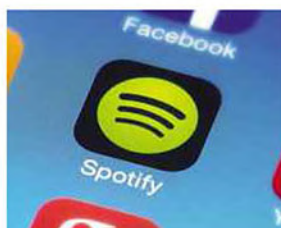
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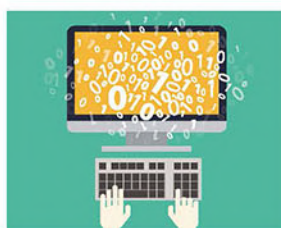
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Developer Cat Burton kept her business running while travelling to the ends of the Earth, equipped with only her trusty laptop. Fancy doing the same? Here's her advice.



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BUSINESS FOCUS

Choose the right backup appliance for your business



Backup is a crucial part of your IT infrastructure.

Dave Mitchell explains how to pick the solution appropriate for your needs

Backup protection for critical systems and data ought to be high on the agenda of any business, but SMBs in particular are faced with a daunting range of options. A purpose-built backup appliance (PBBA) can make the big decisions a lot easier. Once considered the domain of well-heeled enterprises, there are now plenty of PBBAs aimed at smaller organisations, with affordable price tags to suit.

At its purpose, a PBBA is a software backup system that comes preinstalled on a standalone hardware platform, offering everything you need for backup and recovery in one package. However, the vast majority of PBBAs now go way beyond this simple premise. As well as providing target services for data backup on multiple client systems, they often include sophisticated features such as compression, deduplication, encryption and replication.

We've assembled six solutions from the big names in the backup market. On the pages that follow, we put them through their paces in the lab,

and compare their features and capabilities to help you make the right buying decision.

Keep it simple

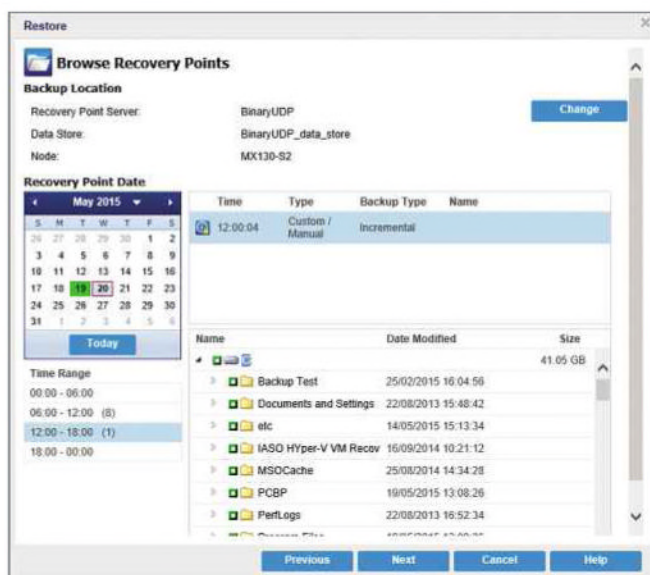
A key benefit of PBBAs is their ability to simplify backup operations. Having a centralised system to handle all clients, with a single management console, minimises support overheads and can reduce operational costs.

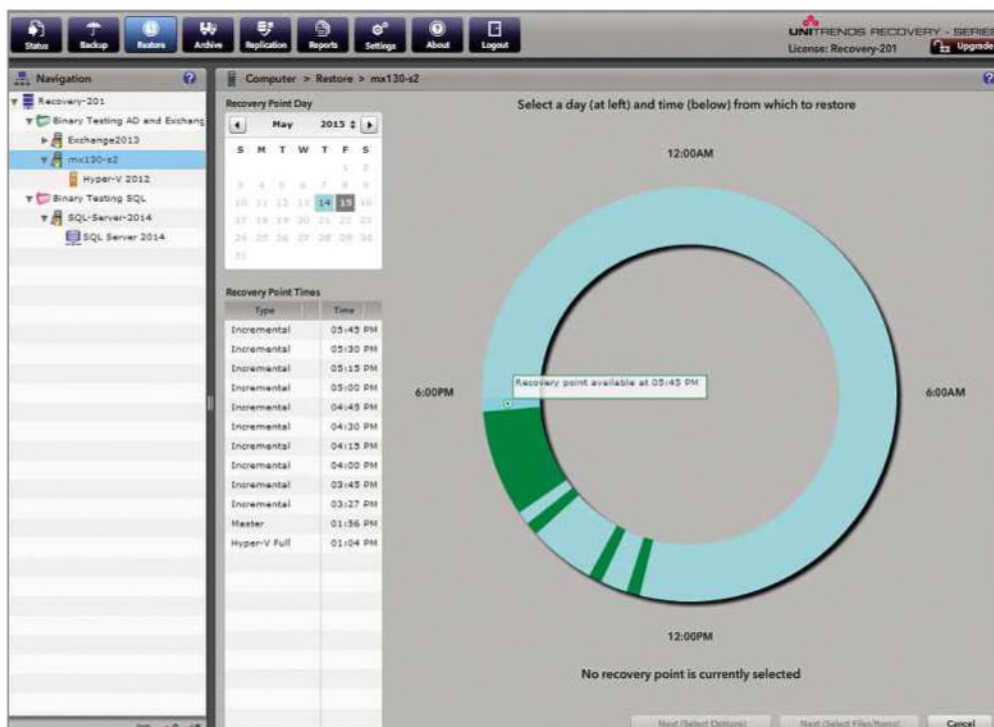
BELOW Restoration using Arcserve's UDP appliance is quick; the software lets you browse recovery points

Deployment is also swift, as a PBBA will normally provide a full set of client agents for various OSes and platforms. For the easiest installation, look for those products that automatically push out the agent to each system as it's declared to the PBBA. Manual agent installation takes slightly longer, although in our experience it shouldn't be a major project. Predefined backup policies also speed up the process: once the agent has been loaded, it can take a base set of instructions from the PBBA and start protection immediately.

You can minimise the need for future maintenance by ensuring you get a PBBA with the right storage capacity and expansion options. Most vendors offer a choice of capacities, with prices rising significantly as they get larger. Consider your current backup storage needs, then calculate how much extra you'll need in a year or two. When you outgrow your current PBBA – and you will – you'll want to uplift to the next size without major disruption.

This calculation isn't always as easy as it sounds, since on-appliance compression and deduplication are often factored into the advertised capacity of a PBBA. These technologies





can make big savings with common files and documents, but if you're backing up large, unique files, such as multimedia projects or big medical images, you won't see anywhere near the claimed reduction ratios.

Licence to back up

Licensing can have a big impact on backup costs, especially for systems where you pay for each system or client that needs to be secured. Fortunately, few SMB appliances use such a model. If you're planning on backing up your workstations as well as your servers, check that your preferred option includes unlimited client licences in the price.

Also consider which types of client you need to secure. It's a given that Windows desktops will be on the list,

but check that the appliance also supports Windows servers. If you have Mac users or Linux systems, make sure they're invited as well.

Don't forget virtual clients, either. SMBs are increasingly taking advantage of virtualisation to cut costs and gain flexibility, so check that your PBBAs can secure and restore virtual machines. All good PBBAs will integrate with VMware and Hyper-V environments; many offer agentless backup that's aware of applications hosted on the VM.

Application backup

For this roundup, we wanted to see not only how good each product was at securing Windows workstations, but also how each handled Windows servers and the latest Microsoft

ABOVE Unitrends' handy colour wheel shows available recovery points

business apps. To test this, we configured one system as a Windows Server 2012 R2 Active Directory domain controller running the Hyper-V role. We then created two VMs, loading Exchange 2013 on one and SQL Server 2014 on the other.

None of the products on test had any problem backing up these systems and applications, but there were significant differences when it came to restoration. It was easy enough to reinstate entire SQL databases and Exchange data stores, but to restore individual mailboxes, or even emails, you need support for message-level backup. Restoration was much easier on some products than others, so it pays to investigate further.

Replication and the cloud

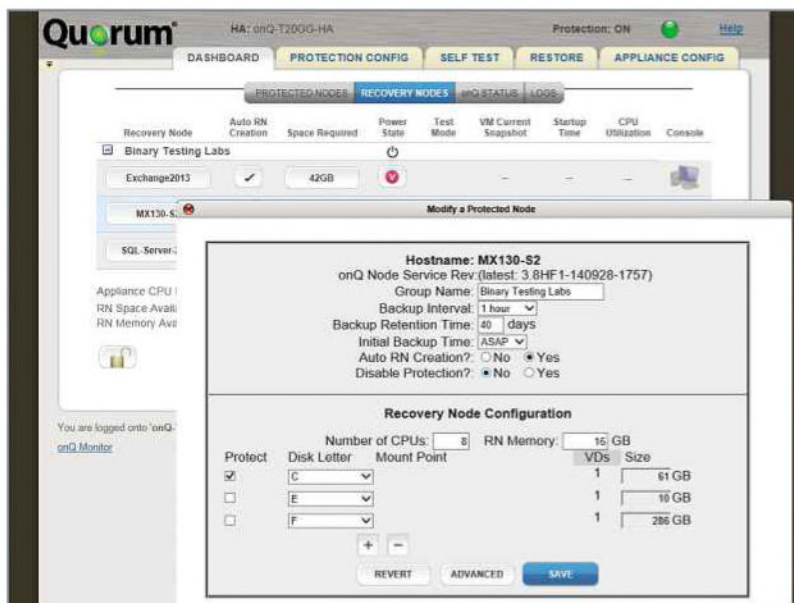
Although a PBBAs can handle all your on-site backup needs, we strongly recommend that you keep secondary copies of your data securely stored off-site in case of disaster. There are various ways to achieve this, but some PBBAs allow you to attach external removable storage or a tape drive for data archiving.

Online replication is a far more efficient solution, however, allowing the contents of the on-site appliance to be copied automatically to a secondary unit located elsewhere. If you don't want to devote manpower to backing up your backups, look for an appliance that can automate this.

The cloud is good too: here, Barracuda sets the standard, since its PBBAs offer a simple, one-click process that automatically replicates

data from selected backup sets to cloud storage. Options from other vendors include support for third-party cloud providers such as Amazon S3.

"Backup appliances represent a significant investment. If a vendor won't provide an evaluation unit, look elsewhere"



Try before you buy
Backup appliances represent a significant capital investment, so it's imperative that you choose the right one for the job at hand. We believe the facility to test an evaluation unit before buying is essential, since it allows you to try out the appliance's features, see how easy it is to deploy in your business and make your final purchasing decision from a fully informed position. If a vendor can't – or won't – provide an evaluation unit, look elsewhere.

By centralising, managing and fully automating the protection of your critical systems and data, a PBBAs can make your life much easier. Not all have the same features and strengths, though, so read on to see which will help you sleep most soundly at night.

LEFT With Quorum, you can define backup frequency and the number of recovery points you want



EXCLUSIVE

Arcserve UDP 7200V

Simple to deploy, with a large backup capacity – a top choice for protecting physical and virtual systems

SCORE ★★★★★

PRICE From £11,350 exc VAT
from arcserve.com

Arcserve's Unified Data Protection (UDP) software has impressed us before, and now you can get it in a purpose-built appliance. The new 7000 Series runs Windows Server 2012 R2 Standard with UDP preinstalled and ready to protect all your physical systems and virtual environments.

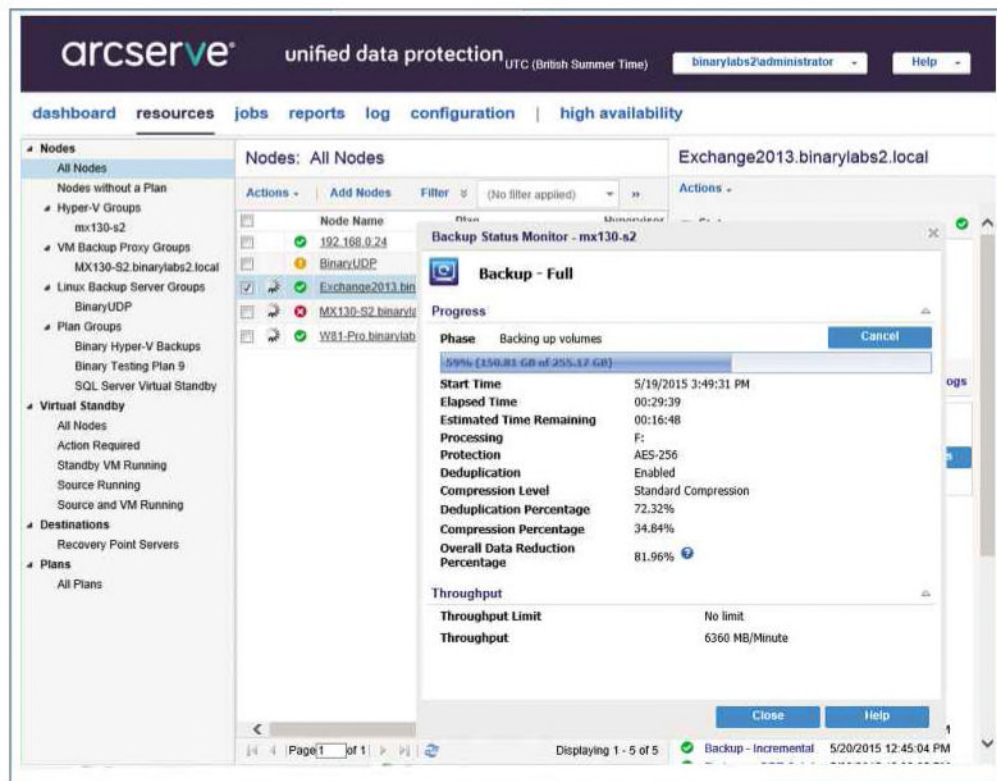
The 7200V model on review has a large backup capacity, with 5.8TB of available space; Arcserve claims that deduplication and compression can push effective storage as high as 17TB. All models use an SSD for the deduplication hash tables, and they come with UDP Advanced, so Exchange granular backup comes as standard.

The "V" in the model name refers to Arcserve's Virtual Standby feature, which uses recovery points to create on-appliance VMs of protected nodes. The 7200V supports up to three VMs, which can be fired up automatically if the source node fails. Another central feature is the recovery point server (RPS); this defines data stores on the appliance to where data is backed up, and provides replication and deduplication services.

Setup was swift. First contact is via a local monitor, mouse and keyboard, and we simply followed the quick-start wizard. Within 15 minutes we'd added the appliance to our domain, enabled AES-256 encryption for the data store and created our first protection plan.

Systems to protect were declared using Active Directory discovery, after which the appliance pushed the UDP agent to them. The agent, which took around ten minutes to install, provides backup and bare-metal recovery services. It also loaded the extra plugins for our Exchange 2013 and SQL Server 2014 systems.

These systems were then assigned a backup plan, which defined a schedule and a number of recovery points to save. Our plan ran



an initial full backup, followed by regular incrementals. We chose to run these daily, but you can make them as frequent as every 15 minutes.

Once the backup was started, the Arcserve's powerful hardware made its presence felt: the 260GB on our domain controller was secured at an average of 79MB/sec. Subsequent incrementals took less than five minutes, and deduplication and compression managed to squeeze our dataset down to only 65GB of on-server storage.

For our Hyper-V VMs, we created a separate plan using the agentless option, browsed the Hyper-V host and imported selected VMs. This only took a minute; we then applied a schedule to back them up every hour.

When it comes to recovery, the options are extensive. To access them, we loaded the node's agent interface from the UDP console; then, using its wizard, we browsed recovery points, selected drives and folders and

ABOVE The UDP software provides a well-designed central console, and the appliance delivers fast backup



"The powerful hardware made its presence felt: the 260GB on our domain controller was secured at an average of 79MB/sec"

decided where to restore them to. SQL databases can be restored using the same method, and we had no problems with Exchange granular Recovery. From the agent's wizard, we simply had to select the Exchange restore option and choose our data store. From there, we could view all users and mailboxes and restore individual emails.

The ability to make data stores accessible as network shares is a particularly useful feature. Once a user logs in, they can browse recovery points from Windows Explorer and restore data themselves using drag-and-drop.

For the Virtual Standby function, the appliance runs the Hyper-V role.

After adding our Windows SQL Server node, we could see from the Hyper-V Manager that a new VM had been automatically created; when we powered down the source node, UDP fired up the standby VM as soon as the 30-second heartbeat we had set timed out.

The UDP 7200V has a high upfront cost, but it's extremely easy to use, delivers a generous backup capacity for the price and offers an excellent range of data-protection features.

SPECIFICATIONS

Supermicro 1U rack server • 2.4GHz Intel Xeon E5-2620 v3 • 32GB DDR4 RAM • LSI SAS 9271-8i PCI-E RAID • 4 x 2TB Seagate SAS hard disks in RAID5 array • 120GB Micron SSD • SAS iPass card for optional tape drive • 2 x Gigabit Ethernet • 3yr hardware warranty



LEFT The setup process is swift: it took only 21 minutes to add the appliance to our domain

EXCLUSIVE

Barracuda Backup 190

It's lean on storage capacity, but scores highly for its simple backup and cloud replication features

SCORE ★★★★★

PRICE Appliance and 3yr subscription, £1,797 exc VAT from barracuda.com

Small businesses seeking hassle-free local and cloud backup should take a close look at Barracuda's Backup 190 appliance. This diminutive desktop box supports an impressive range of client systems, and the icing on the cake is one-click cloud replication.

What you don't get on this low-end model, however, is much space. The Backup 190 has one 500GB SATA hard disk; once the OS has taken its bite, you're left with only 250GB of usable space. That said, Barracuda's variable block level deduplication can increase the capacity available significantly: during testing, we backed up 220GB of data and saw the Barracuda scrunch it down to 142GB. If you need to back up terabytes of data, however, you'll need a more expensive model.

Installing the Backup 190 is a breeze: setup took us less than half an hour. After a quick local session to set the appliance's static IP address and DNS details, it was straight over to the Cloud Control portal for all further management. Using the serial number and code provided in the box, we were able to add the appliance to our cloud account easily; then, we moved on to setting up backup schedules.

Finishing the job required a little manual setup: an agent must be

downloaded from the portal and installed on all backup candidates. But this is an easy task, since all Windows systems use the same agent, which takes seconds to load. From the portal, we declared each client using its IP address or domain name, and could then browse file systems, audit system states and applications, choose what we wanted to secure, and assign backup schedules.

When it comes to cloud backup, things don't get any easier. Your local storage is automatically linked to a cloud account of the same capacity; if you tick the relevant box when declaring a system, cloud replication is handled transparently thereafter, with no further intervention required. If you want off-site replication too, Barracuda can do that. You can link the Backup 190 to a remote appliance from the portal, then tick another when adding your sources to have all selected data replicated to that system.

In testing, the appliance didn't complain about any of our backup choices. We had no problem declaring our Windows Servers, Hyper-V hosts and VMs, Windows workstations, Exchange 2013 data stores and SQL Server 2014 databases. Message-level backup for Exchange wasn't tricky to

ABOVE The Backup 190 can be managed remotely using Barracuda's Cloud Control portal



"Your local storage is automatically linked to a cloud account; cloud replication can be handled transparently thereafter"

set up, either: we followed the clear instructions to create an Exchange service account and were happily backing up our user's mailboxes ten minutes later.

Backup performance wasn't great: a full 39GB backup of our Windows AD server averaged only 22MB/sec. That's not necessarily a big problem, though, as Barracuda employs an "incremental forever" system that runs one full backup followed by regular incrementals; we found these took only a few minutes to complete. Schedules can be set for specific times and days of the week and repeated as often as every 15 minutes.

To restore our data, we selected folders and files from the portal and simply decided where to send them. Entire Exchange data stores and SQL databases can be restored, and you

can browse mailboxes and reinstate individual messages. To restore files from cloud storage, you can select the Download option from the Restore page and specify where to copy them. This works for

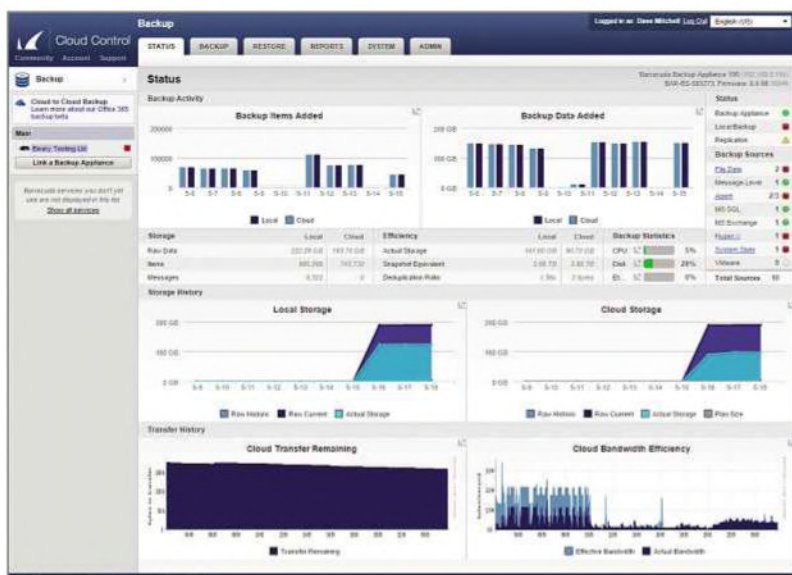
SQL and Exchange backups as well as regular files; we downloaded databases as Zip archives and individual email messages as EML files.

With only 250GB of raw backup space, the Backup 190 is pricey, but you won't find an easier way to implement local and cloud backup. Deployment is quick, and ongoing management is simplicity itself – it really is a complete data-protection solution in a box.

SPECIFICATIONS

Desktop chassis • 500GB SATA hard disk • 4 x USB 2 • Gigabit Ethernet • External PSU • includes 3yr Energize Updates and Instant Replacement subscriptions • 254 x 210 x 59mm (WDH) • optional cloud storage: 200GB/yr, £385; unlimited/3yr, £1,099 (both exc VAT)

LEFT Barracuda's message-level backup support makes light work of restoring individual emails for Exchange users



EXCLUSIVE

DataFort Critical Care

This managed backup service takes care of everything, giving you data security without the stress

SCORE ★★★★★

PRICE From £300 exc VAT per server per mth from datafort.com

If you're short on time, short on staff and lacking in technical expertise, DataFort's Critical Care service may be just the thing your business needs. The company provides on-site and off-site protection, with disaster recovery for key systems, and the real clincher is that DataFort looks after every aspect of it for you.

The Critical Care pricing structure is based on the number of servers to be protected, rather than the amount of data being secured. This means you don't have to worry about getting the right-sized appliance upfront, and you can keep to a predictable budget no matter how your data-storage needs grow. Prices start at £350 per month for the first server, and £300 for each extra system. DataFort also offers a granular email recovery service for Microsoft Exchange, which costs an additional £50 per data store per month.

As mentioned above, the basic price also includes disaster-recovery invocation. So if you can't get into your office – perhaps due to a flood,



ABOVE DataFort's local backup appliance is a top HP ProLiant Gen8 rack server



a fire or the like – DataFort can fire up cloud-based VMs of your protected systems, so you can carry on working from another location using the supplied VPN router. In case of hardware failure, DataFort can also image a replacement server for you.

Getting set up was as easy as picking up the phone to call DataFort, and then pointing to where we wanted the on-site appliance to be located when the technician arrived. DataFort provided a good-quality HP DL160 Gen8 rack server and set it up to take image backups of our Windows Server 2012 R2 domain controller, Exchange 2013 and SQL Server 2014 systems every 15 minutes.

Once full image backups had been taken, these were then automatically updated at the desired intervals using snapshots. There was nothing at all for us to configure ourselves; indeed, we had no access to the on-site appliance, which is managed and monitored remotely by DataFort. Backed-up data is replicated to servers at DataFort's Tier 3 data centre, and the installation technician took away an encrypted copy of our data on removable media to seed the cloud vault. If data retention is an issue for your business, then DataFort's off-site archives can also be used to meet Financial Conduct Authority compliance guidelines.

After leaving our systems running for a few days, we ran through a variety of scenarios to see how DataFort responded. To test file recovery, we deleted a folder containing 300 files on the AD server, then phoned DataFort to request restoration. Our call was answered immediately, and the folder was restored from the latest local backup in less than four minutes.

For our next test, we then deleted all emails from two users' inboxes, then called up again and asked for them to be restored from the latest backup. After 30 minutes, the operation was complete and all emails had been recovered (to the obvious relief of our users).

Next, we instigated a simulated Exchange server crash: we powered off the VMware VM running this service and asked DataFort to instigate failover to the local appliance. This took 35 minutes, and was carried out so seamlessly that when users loaded Outlook and OWA they were entirely unaware they were using the backup local VM instead of the main server.

"Failover was so seamless that when users loaded Outlook and OWA they were unaware they were using the local backup VM"

Finally, we powered down the entire VMware host to simulate a complete loss of all services, and asked for full cloud invocation. DataFort called us back an hour later to confirm

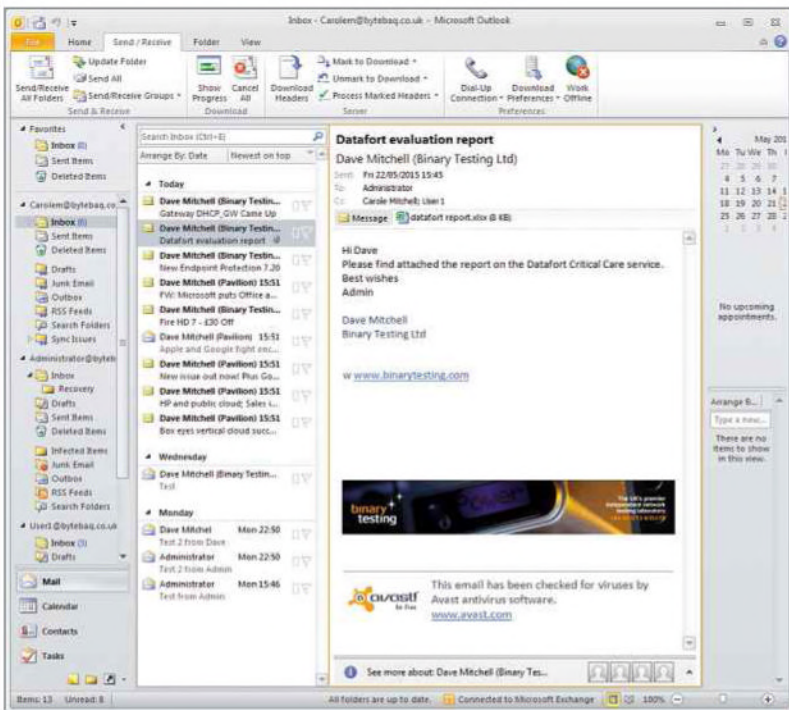
that all our systems were now running in the cloud. Once again, our users continued to use Outlook and OWA to access their mail as normal; using DataFort's VPN router meant they didn't need to change any application settings, and when we turned our own systems back on, DataFort brought everything up to date by applying all changes from the cloud servers.

Time-poor businesses will love Critical Care, since it takes the entire data-protection load off their shoulders. We found the managed backup and recovery processes seamless, and basing costs on protected systems rather than capacity makes it very affordable too.

SPECIFICATIONS

HP ProLiant DL160 Gen8 1U rack server (local appliance) • hardware specification built to customer requirements • Includes 9am-5pm recovery services • Optional Exchange granular recovery: £50 per data store per mth

LEFT After the simulated disaster, our Outlook users continued working as normal using the DataFort cloud backup servers



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Netgear ReadyDATA 516 with ReadyRecover

An expensive system that didn't work smoothly for us – if you're seeking peace of mind, look elsewhere

SCORE ★★☆☆☆

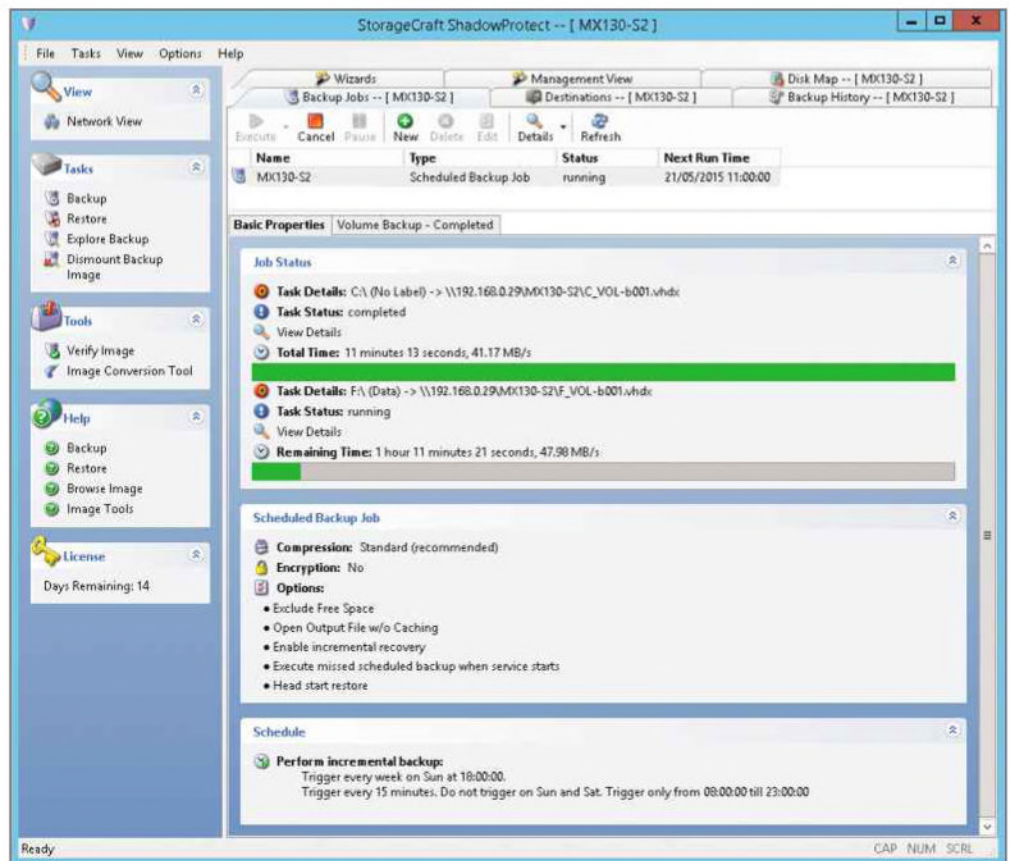
PRICE Diskless appliance, £1,053 exc VAT from netgear.com

Netgear's SMB backup and recovery solution pairs ReadyDATA appliances with StorageCraft's ShadowProtect 5 software to deliver image-based backups and fast block-level, incremental snapshots. While the ReadyDATA 516 on test offers six hot-swap SATA bays, there's a catch: they accept only Netgear-signed drives, with 4TB models costing an exorbitant £600 each. With the appliance priced at more than £1,000, you're looking at nigh on £3,500 for a 16TB unit. You also have to buy a ShadowProtect licence for each server, workstation and virtual host, costing £649, £60 and £268 respectively.

Netgear has done a reasonable job of integrating the hardware and software. To get started, we logged in to the appliance's web interface and created a RAID5 array from the four 1TB signed drives provided. From here, ShadowProtect takes over. Only one system requires the full product, which includes the management console and agent. For the rest, an agent must be manually installed and a reboot is required. The user guide fails to mention that the custom install option must be selected.

For our Exchange 2013 and SQL Server 2014 systems, we chose the custom install and selected the agent, snapshot driver and mount service components. Using the backup wizard, we picked the drives to be secured and chose the predefined ReadyDATA 516 option as the network location. After connecting, the console displayed our RAID volume, asked for login details and let us decide when snapshots should run, which can be as often as every 15 minutes.

ShadowProtect created a dedicated network share on the appliance for each system and got on with the full first backup. Performance was good: the two drives on our AD server were secured at an average of



43MB/sec, with further incrementals taking less than four minutes. Next, we manually declared our other servers to the console using their domain names and administrative accounts. We used the same procedures to create backup strategies for each.

The appliance's web interface shows how much storage each client is using and whether their agents are connected. All recovery points on the appliance are made available as network shares, so you can browse within Windows Explorer using UNC paths. From a Windows 7 client, we selected a VHDX file, mounted it using the ShadowProtect Quick Mount menu option and restored data using drag and drop. The ReadyDATA's own deduplication feature isn't enabled

ABOVE The console can access other systems running the ShadowProtect agent and manage their backups

on these shares, but compression is, so there are space savings to be made.

We achieved the same results from the management console on this client – but we hit problems when trying to access the recovery points from our Windows Server 2012 R2 systems. All attempts to mount the VHDX files failed with corruption errors; Netgear said the only solution was to repair the ShadowProtect installations on all clients, requiring further reboots.

"Performance was good: the two drives on our Active Directory server were secured at an average of 43MB/sec"

There are no options for the swift recovery of SQL databases, and the optional Granular Recovery for Exchange tool isn't easy to use. It runs on any system other than the Exchange host,

and opens ShadowProtect image files, allowing you to browse mailboxes and restore items using drag-and-drop.

Netgear's ReadyRecover didn't impress us enough to justify its cost. Indifferent documentation hampered setup, and the errors we encountered made us wary of using it to protect data on critical systems.

SPECIFICATIONS

Desktop chassis • 3.3GHz Intel Core i3-3220 • 16GB ECC DDR3 RAM • 6 x hot-swap 2.5/3.5in SATA drive bays • supports RAID0, 1, 5, 6, 10, 50, 60, hot-spare, JBOD • 2 x Gigabit Ethernet • internal 200W PSU • web browser management • 192 x 288 x 259mm (WDH) • 5yr RTB warranty



LEFT We hit problems when trying to access recovery points from our Windows Server 2012 R2 systems

EXCLUSIVE

Quorum onQ-T20

SMBs worried about their server-protection strategy can rest easy with Quorum's recovery-testing features

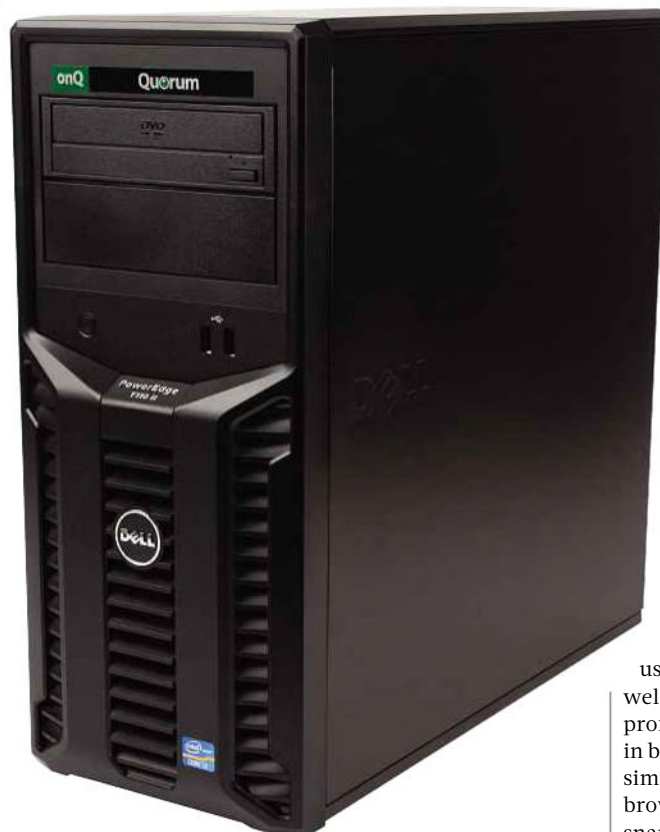
SCORE ★★★★★

PRICE From £5,162 exc VAT
from quorum.net

Quorum's onQ-T20 offers one-click backup operations for Windows servers, and also has a clever sideline in disaster recovery validation. Supplied as a Dell PowerEdge T110 II tower server, the appliance regularly tests its own backups in the background to ensure you won't be caught out if something goes wrong.

Getting started with the onQ-T20 was almost effortless: the appliance integrated into our Windows test network in less than ten minutes, and our first backup was running five minutes later. Setting up clients is a simple case of opening the appliance's web console on each system and clicking the Protect Me button to install the onQ agent. You'll be asked how you'd like protection and recovery to be configured, and then the backup kicks off.

With agents on our Windows Server 2012 R2 AD controller, Exchange 2013 and SQL Server 2014 systems, our first complete backup took around two hours. Once it was finished, the appliance created a recovery node (RN) for each system – a complete VM kept permanently on standby for when it's needed. Subsequent runs take only a few



minutes; the agent takes incremental snapshots and updates the RNs with deltas. Schedules can be assigned to each system, ranging from 15-minute to 24-hour intervals.

Internally, the appliance runs Citrix XenServer, but you can ignore this, since everything is managed from the web console. The dashboard provides a display showing activity and updates on the status of protected nodes and RNs, and you can choose how many snapshot versions to keep, along with the number of virtual CPUs and the amount of memory to be assigned to their RNs. This is also where you can set the timetable for recovery tests: at scheduled intervals,

ABOVE Quorum's recovery nodes can be fired up either in the production network or a private one

the Quorum checks that each RN is readable and will boot up. If it fails, an email alert is automatically fired off. You can also run manual tests where the RN is loaded in a private network.

The only disappointment is the onQ Monitor utility: it provides limited information about activity, along with basic pie charts showing backup and recovery status, but it's devoid of any useful reporting tools.

We tested Quorum by closing down our Exchange 2013 system and opening its RN in the production network, accessible via the system's connection status icon in the dashboard. In around five minutes, the RN had loaded and presented us with a perfect duplicate of our production server. From our user's perspective, this might as well have been the real deal, as their profiles continued to work perfectly in both OWA and Outlook 2013. For simple file and folder recovery, we browsed the contents of the RN snapshots from the onQ console's Restore tab and copied them back to selected destinations.

Full system recovery is a lengthier process. When we brought our original Exchange server back online, we had to boot it from the Windows PE-based Quark (Quorum Ultimate Automated Recovery Kit) ISO, which we downloaded from the appliance, in order to synchronise all the changes made while the

Exchange 2013 RN was in use. After connecting the Quark recovery environment to the onQ appliance, it took around an hour for all the latest changes to be applied

to our Exchange 2013 server.

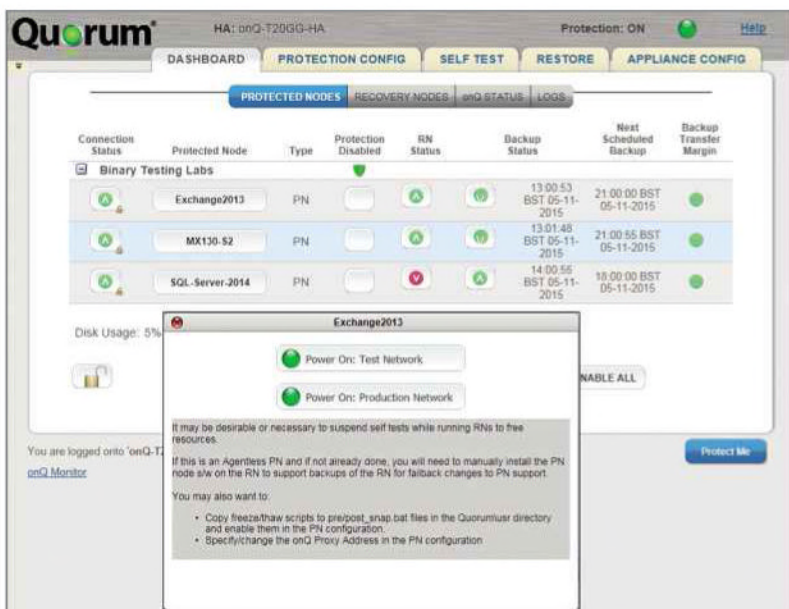
The onQ-T20 comes up to 1.25TB of data and comes with an unlimited server licence, but Quorum recommends it for no more than two recovery nodes: after all, these VMs require a certain amount of CPU power and RAM, and also need as much disk space as the original production system. Even so, the one-click backup and automated recovery testing make this a great choice for situations where failure is not an option.

SPECIFICATIONS

Dell PowerEdge T110 II tower server • 3.4GHz Intel Core i3-3240 • 16GB 1,600MHz DDR3 RAM • Dell PERC H200 RAID • 2 x 4TB Dell SAS 6Gbits/sec mirrored hard disks • 2 x Gigabit Ethernet • 189 x 420 x 464 (WDH) • 3yr on-site NBD warranty

"The only disappointment is the onQ Monitor utility: it provides limited activity information, but it's devoid of useful reporting tools"

LEFT Quorum creates recovery nodes for your servers and tests them regularly to make sure they'll load up



EXCLUSIVE

Unitrends Recovery-201

Agent deployment could be smoother, but Unitrends scores highly for client support, features and value

SCORE ★★★★★

PRICE Appliance and 1yr support, £940 exc VAT from unitrends.com

The Unitrends Recovery series of appliances promise backup and recovery with no hidden costs. They'll protect all your servers, clients, OSes and apps out of the box, so the only calculation to be made is how much data you need to protect, and whether you need redundancy – and hence which model to choose.

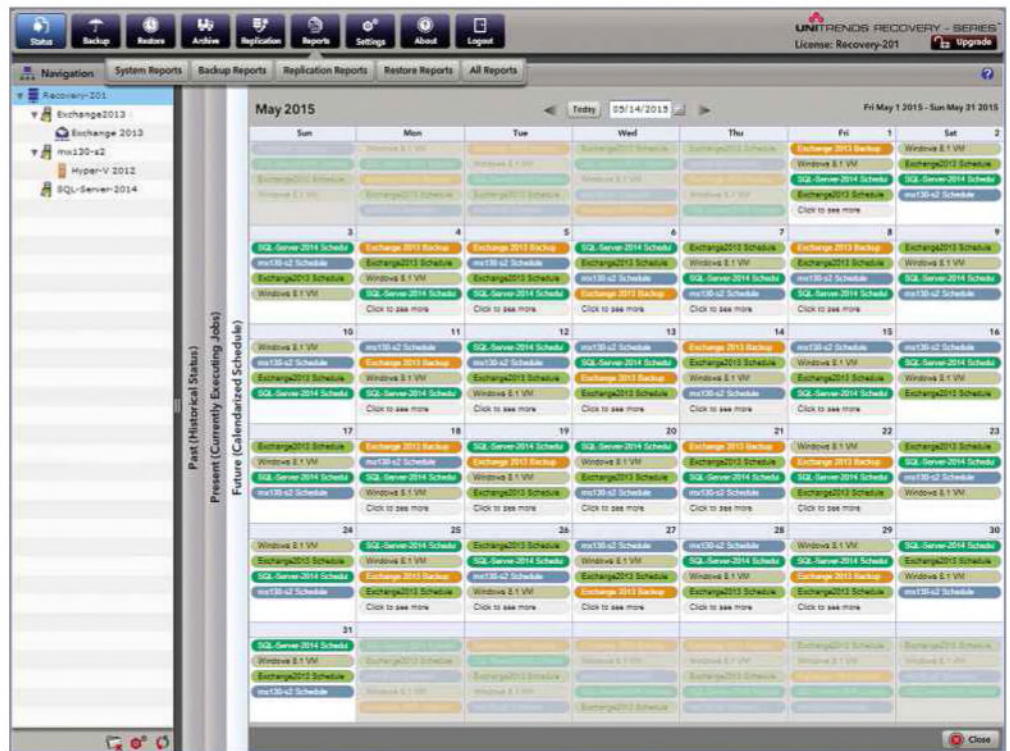
The entry-level Recovery-201 is a compact desktop unit that comes with the Unitrends software preinstalled. All key features are enabled, and it supports Windows, Unix, Linux and OS X; applications such as Exchange, SQL Server and SharePoint; plus Hyper-V and VMware environments.

Storage in this model is handled by a single 1TB SATA hard disk; if you want local redundancy, consider the larger models which have mirrored or RAID5 arrays. The Recovery-201 provides up to 600GB of usable backup space, which is stretched as far as possible by inline compression and block-level deduplication.

The appliance also offers one USB 3 and four USB 2 connectors, which can be used to archive data off the appliance. iSCSI LUNs and NAS shares are also supported, and the Unitrends CloudHook feature supports Amazon S3, Google and Rackspace for cloud archiving.

Setup took ten minutes, but agent deployment was a lengthier process. Due to security changes made by Microsoft, the agent-push function doesn't support Windows Server 2012 R2 or 8.1 systems, so we had to install the agent manually on these systems, then add the clients from the console with the "Establish Trust" box unchecked. The appliance was also aware of Hyper-V and Exchange 2013 and, with the latest updates installed, SQL Server 2014.

The default "incremental forever" backup method runs one master backup when a system is first connected, then follows it with



regular incrementals as often as every 15 minutes. However, if you wish, you can configure custom settings using master, incremental, differential, selective and "bare-metal" backups, which can be further customised with inclusion and exclusion lists.

With automatic settings, our Exchange 2013 and SQL Server 2014 databases were secured without any problems. Backups of our Hyper-V VMs could also be scheduled, and these occurred regardless of whether the VMs themselves were running or shut down.

Performance proved variable: a Windows 8.1 Hyper-V VM Master backup averaged 27MB/sec, but Exchange database backup was much slower, at 17MB/sec. A 70GB Master system backup of our Windows Server 2012 R2 AD controller took almost two hours, but was squashed down to only 40GB, and subsequent incrementals completed in less than five minutes.

ABOVE You won't find a larger choice of client agents than those offered by Unitrends

"Backups of our Hyper-V VMs occurred regardless of whether the VMs themselves were running or shut down"

BELOW The appliance comes with every agent imaginable, as well as excellent scheduling features

Recovering files and folders is quick and easy: from the console, we chose a machine, picked a recovery point and watched as a 1.2GB folder was restored to a Windows server in only 65 seconds. Our Exchange database was just as easy to reinstate, but message-level restoration

requires additional tools, such as Kroll Ontrack.

The Unitrends Instant Recovery feature can also create a VM from a system backup and host it on the appliance, but the low-end Recovery-201 lacks the power to do so. What you can do, however, is build a VM from a backup and run it on a Hyper-V host system.

Users can also be permitted to run their own backup and restore jobs, but the local agent interface has been deprecated and no longer works. Therefore, we had to go into the appliance's own interface to configure users, grant them access privileges and allow them to use the web console on their machine.

Hiccups such as this reflect the fact that the Recovery series is going through a transitory upgrade phase, but none of them are insurmountable. The Recovery-201 is still a decent choice for small businesses that want total protection at a rock-bottom price. ●

SPECIFICATIONS

Desktop chassis ● 2.41GHz Intel Celeron J1800 ● 8GB DDR3 RAM ● 1TB Seagate Constellation SATA hard disk ● USB 3 ● 4x USB 2 ● Gigabit ● 220 x 349 x 130mm (WHD) ● internal PSU ● 1yr RTB warranty



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THE BUSINESS QUESTION

Should you outsource your IT support?

Do you still need to keep your IT support staff on the payroll?
Darien Graham-Smith explores the benefits of outsourcing

IT support underpins almost every business. If your computers don't work, your employees can't work. But rather than investing in full-time support staff, many companies have turned to independent consultancies to keep their systems running smoothly. Is it time your business followed suit? Or is putting your operations in the hands of a third party asking for trouble?

■ The benefits of outsourcing

The chief attraction of outsourcing is obvious: it saves money. "Outsourcing your IT support, with the right provider, is a great way of maintaining your systems without the cost of employing full-time IT staff," pointed out Piers Davies-Smith, lead engineer at One IT Support in Tynemouth (oneits.co.uk). That applies especially to smaller organisations: "We support

some clients as small as two users," he revealed. "Our contracts are much cheaper for them than hiring qualified staff. The same rings true of medium-sized businesses with 10-20 employees."

Then there's the question of experience. If a small business wants to take on staff, it's unlikely to be able to afford a highly qualified systems administrator. "If you have a client database that your company needs to function every day, do you want someone with minimal experience maintaining it?" asked Davies-Smith.

And then we come to availability. "Your IT guy is a single resource, and can realistically perform only one task at a time," said Jamie Wilson, technical director at Novatech in Portsmouth (worryfreecomputing.com). "Dedicated staff will have holidays, sick days and so forth.

An off-site service provider will have a pool of resources available to respond to problems, and escalation procedures for urgent issues."

■ One size doesn't fit all

Outsourcing isn't suitable for every business. As a rule, it makes the most sense for small organisations. "Companies much larger than 30 employees often debate the pros and cons of external support," said Davies-Smith. "At this size they typically could afford to employ a reasonably qualified engineer to maintain their network."

Former support agent Peter Snow agrees that the calculation changes as an organisation grows. "Larger companies are better off having their IT in-house. It's more controllable in terms of management, and it's a lot better for the experience of the user when you're dealing with someone who's based in the building and really knows about your systems."

For a mid-sized company, a combination of in-house and external expertise may be ideal. "Some firms prefer to have someone on the ground to assist users with minor issues, but opt to outsource network and server maintenance," said Davies-Smith. "Many IT support providers offer this service as an option, allowing their clients to keep the critical stuff under heavily trained supervision minus the associated costs of desktop support."

■ Caveats and cautions

If you're considering outsourcing, there are risks that you should be aware of. For a start, it's vital to make sure your chosen service can cover your needs. "Any managed service agreement should be structured around predefined service levels, including response and resolution times," explained Novatech's Wilson. Unfortunately, things can fall through the cracks: "Some IT support providers don't have adequate staffing or training," warned Davies-Smith.

And what happens if you enter a contract that doesn't fully match your needs? "One of the support providers we've had to work with has no service-level agreement (SLA) with the client in relation to speed, and takes days to respond," Davies-Smith told us. In a case like that, you may be out of luck: "IT companies only want to work to their SLAs," noted Snow. "If a job falls outside of their remit, they don't want to know."

One specific issue Snow warns against is relying on remote support. "If a support company wants to do everything remotely, I start to worry. The way

"If a small business wants to take on staff, it's unlikely to be able to afford a highly qualified systems administrator"

they look at it, if they have someone sat at a desk then that person can be looking after ten companies at once. But what's the cost to your business? If your workforce isn't getting responsive IT support, then they're not happy and they're not productive. It just drags your whole team down."

Lines of accountability can also blur when a contractor has access to business-critical operations. "If an engineer is on site when something goes wrong – but they have acted correctly, and the failure is out of their control – then no liability is generally incurred," said Davies-Smith. "Read the small print to find out where liability begins and ends."

When it comes to data security, a good support provider should give you options. "Most companies protect their data by way of a non-disclosure agreement, signed by the contractor," said Davies-Smith. "We've done just this with a solicitor, whom we offer fully outsourced IT support."

Novatech adopts a more formal approach: "We ensure that all helpdesk staff go through an enhanced DBS [disclosure and barring service] check," Wilson told us. "We then ensure that the client's data is structured correctly, with appropriate permissions to ensure that we don't have access to things we shouldn't see. In this way, we can make sure that key tasks (such as backups and antivirus scans) are performing as they should, while ensuring that the customer's data remains secure."

■ What to look out for

The key message is that moving to outsourced IT support isn't something to be done lightly. The first priority should be to ensure that your incoming service understands and can provide the service required.

Wilson noted: "Before taking on a customer, a managed service provider should perform a full audit of the infrastructure and equipment they'll be supporting, as well as visiting sites to meet people to talk about the IT issues they're currently facing."

Once the terms are agreed, "the best option is definitely a transition period", recommended Davies-Smith. "Make sure it's written into your contract that your support company will spend time on site working with your existing IT resources to get to grips with your network."

The harder part is choosing a firm to work with in the first place. "In our line of work we hear many horror stories, as well as ones of praise," said Davies-Smith. "It's about finding the right provider – which often doesn't mean the cheapest."

As someone who's worked on both sides of the business, Peter Snow agrees wholeheartedly: "I used to work at a consultancy called KTS Computers, based in St Ives, and we would frequently visit customers whose previous IT provider had left them in the lurch, or turned around and said 'do it our way, or we're not doing anything for you'. We had to go in and say 'not all companies are like that!'"

"One issue can be the capacity of the outsourcing agency. I did some work at a company based in Ely, which had been using a small firm for its IT needs. The firm had actually done a great job – but as the client grew to 20 or 30 users, the company couldn't keep up," Snow said.

"At the other end of the scale, there are support

"Make sure it's written into your contract that your support company will spend time on site working with your existing IT resources"

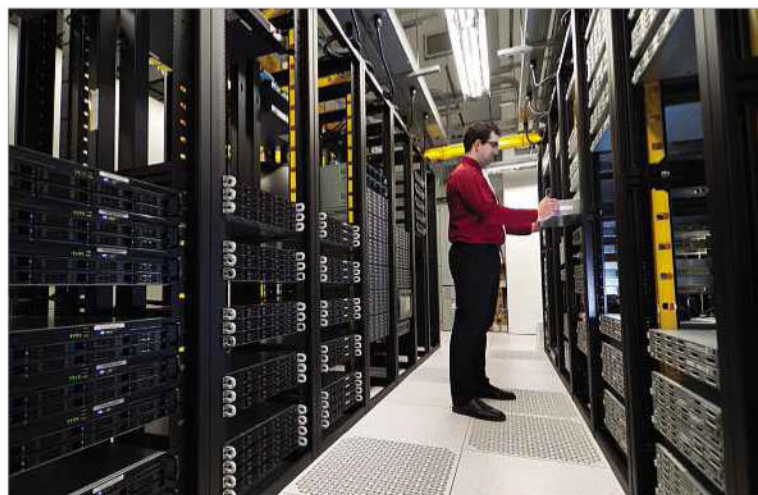
companies that are too big and corporate. If their representative comes in with glossy brochures, I suggest you show them the door right away – that's a salesman, not

an engineer. I don't want to hear 'we can support x computers for x pounds a day' – I want someone who will ask me what we need, and invest in my business as much as I'm investing in them."

"The final thing I'd say is to keep it local. A local firm will know the local infrastructure: they'll know the best service providers, and where to source equipment at very short notice."

"Plus, there's the time issue. At KTS we'd regularly say 'sorry, we can't support you' to customers more than an hour's drive away. Technically, we could have supported them, but when a client's server has gone down and they have a presentation in 30 minutes, we don't want to be saying 'sorry, it's not going to happen', just because we can't get there in time." ●

BELOW Check the small print, and make sure you understand who's accountable in the case of a system failure



The expert view Steve Cassidy

As a consultant, I should really be in favour of outsourcing. In reality, nothing could be further from the truth. Most of my work is

with board members, and what might seem clear-cut to a manager tasked with saving money rarely looks so plain and simple at board level.

It's certainly true that there are successful outsourcing companies, and happy outsourcing clients. But there are also departments, crucial to their respective businesses, that are far from happy to see the arrival of outsourced support. Sometimes the contract involves the in-house IT staff actually being taken on by the outsourcer – popular among larger companies because it promises continuity while getting them out of a pension commitment. But things don't always work

out so well in practice: I know of one business that transferred its IT staff to an outsourced provider, which then treated them so badly that a number of vital people simply resigned.

So when you're thinking about whether your business fits the outsourcing model, it's absolutely vital to clearly appraise the role of your IT resources – not just how many Excel licences you have, but what your people actually do, for and inside your business. I realise I'm implying that many businesses undervalue their in-house IT staff: the reality is that this is frequently the starting point for a courtship ritual with an outsourcer.

Once you've made that appraisal, you may conclude that outsourcing is indeed right for you. If you're absolutely reliant on one person who has an overview of all your systems, then maybe winking

them out is good for all concerned: you get lower dependency, and they get a career-advancement path. Yes, I realise that involves being fired, and nobody welcomes that. But if you're that useful to one company, you can be that useful to others too.

The posh term for this overall problem is intellectual property. Companies value their trademarks, their designs, their media and so forth, but they almost never put the same value on their procedures, their custom systems, or the expertise of their staff. Outsourcing throws a stark light on this gap in valuation. My advice, every time, is that low-expertise roles are ripe for outsourcing, but high-expertise ones aren't. Which type of roles you're dealing with is something you'll have to figure out: an outsourcing company representative certainly isn't the best person to tell you.

Disaster recovery

Is your business ready for the worst?
Steve Cassidy explains how to minimise
the damage when things go wrong



■ Our business isn't based in an earthquake zone. Do we really need to worry about disasters?

Of course, it's unlikely that you'll be struck by an earthquake, flood or terrorist attack. But, from a business perspective, a disaster doesn't have to be a major physical incident: it could be any unexpected change that interrupts your ability to operate. This means you can't stay safe by focusing on only a narrow, well-understood category of disturbances. You must plan for the unexpected.

■ We already have backups and UPS, so surely we're covered?

Back in the days when a company's IT department was responsible for a few hundred megabytes of files and the odd database or two, these measures might have been considered sufficient. Today, the technology resources we rely on are much more varied than anything a simple tape archive can protect. This includes the disaster-recovery system itself: one of my most confident clients was very proud of the UPS they'd bought for their "definitive email archive" PC; unfortunately, the unit was positioned beneath a window, which had been left open on a hot day when a thunderstorm hit. Do I need to draw a picture?

■ Should we protect ourselves by moving everything into the cloud?

Moving data and services into the cloud can protect you from certain types of disaster, but it brings new risks, too. You need to maintain access to your online resources, and be sure that your cloud provider can provide the performance and availability you need. Recently, for example, data centres in Texas have seen outages caused by storms and flooding. Quite a lot of nominally cloud-based businesses now use local servers as backup environments, which is the opposite of the way things used to be.

■ Our suppliers say they're fully ISO-certified, so at least we don't have to worry about them – right?

An ISO certificate certainly isn't a bad thing, but the process of getting one is inevitably backward-looking. We have educational suppliers shipping iPads whose safety tests focus on the moving

parts in floppy drives and CD-ROM drives, but entirely overlook the potential dangers of a glass touchscreen. Evidently, the nature of the last recorded disaster is no guide to the source of the next.

■ Why is our disaster-recovery consultant telling us to write down our passwords? Isn't this supposedly a bad idea?

Yes – if a malicious intruder were to get hold of your passwords, it could be a disastrous. But if your business relies on a password that's known only to one person, you're setting yourself up for trouble when that person leaves the company or can't be reached. In the past, when businesses relied largely on local servers, databases and so forth, the administrator could always reset a password if need be, but things aren't so simple with external services. Ideally, you'd ensure you weren't reliant on a system that ties security to a specific individual. Of course, this isn't strictly a disaster-recovery plan, but rather a business-continuity strategy, since it's based on avoiding problems in the first place.

■ So, what should we be doing?

Someone in your organisation needs to wear the disaster-recovery hat. It need not be someone senior, nor someone techie, although either or both can help. Don't assume that the most organised person is the best candidate: someone who's accustomed to order may not respond well to unexpected events.

Whomever you appoint, don't expect them to keep you perfectly safe. Disaster recovery

"Disaster recovery can't ever be a finished project, nor is it something that can be entirely placed in one person's hands"

can't ever be a finished project, but almost any plan is better than nothing. Nor is disaster recovery something that can be entirely placed in one person's hands: make sure that people who might have to make decisions or adapt their procedures in a disaster

know what's expected of them.

Consider a close-to-home example: when the Eyjafjallajökull volcano erupted in Iceland in 2010, leaving *PC Pro*'s editor stranded in Japan for a week, the office-based staff had no specific contingency plan for what to do. But clear lines of responsibility allowed the team to adapt and keep the production schedule on track. ●

The jargon

Gap analysis A retrospective study of recovery procedures, carried out after a real or simulated disaster. What went wrong, why did it go wrong and what lessons can be learned?

RPO Recovery point objective: the last known good state of the system being recovered. The point you need to get your business back to in order to effect a recovery.

RTO Recovery time objective: how long it should take your business to get up and running again after a disaster. Taken with RPO, this gives an overall picture of the business impact of a disaster.

Secondary site A location hosting unused duplicates of critical systems, ready to be switched to should the main site be out of action.



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**PETER COCHRANE OBE,
FUTUROLOGIST**

The ex-CTO of BT sets out his ideal vision for collaboration and communication. What's coming? What's important? What are people doing wrong? What will collaboration look like in 2017? And what should you do next?

FINANCE KEYNOTE

**KAT MANDELSTEIN,
PRICEWATERHOUSECOOPERS**

Kat explains how to build a strategy for investment that will convince your board or CFO that it's time to invest. From best practice to company culture to pitfalls, what do you need to consider?

CASE STUDY

**IAN MCBETH,
FURNITURE VILLAGE**

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JON HONEYBALL

“I’m going to stick my neck out and suggest that moving onto Windows 10 sooner rather than later will pay off”

Windows 10 is a much cleaner, more coherent OS than Windows 8 or 8.1; even business users should be getting ready to make the leap

The rush to get Windows 10 ready for release continues apace. It’s only a few weeks until the planned escape of the product, and there’s still much to be done – in fact, there’s too much being changed in these last moments to make me feel entirely comfortable. However, launching anything of this size is always going to be a massive undertaking, and it’s easy to forget just how complex a process it is. Am I still confident about Windows 10? Yes, but I’ll confess still somewhat guardedly. It’s definitely so much better than Windows 8/8.1 that any comparison feels unfair; I can’t wait to move all of my desktop test computers in the lab onto Windows 10 and be able to put the nightmare of 8/8.1 behind me. I hated the bizarre thinking behind Windows 8 from the start, and 8.1 helped only partially. Windows 10 is like a welcome breath of fresh air.

However, I’m concerned by the number of businesses still content with Windows 7 64-bit (not that there’s much wrong with that; it works very well, in the same way

that XP worked so well in the business environment for so long). Getting businesses to make the transition to Windows 10 will be critical for Microsoft, since the company needs to reduce the spread of versions of its platform out in the wild. Another area that’s giving me concern is the speed of both upgrading and updating. I’m finding that these Fast-ring interim builds are taking a long time to install, and continue to be plagued by those old Microsoft bugbears – fuel gauges of task completion that linger around like limp corpses but suddenly leap into life, or that crawl to some arbitrary amount and then hop straight to 100%.

As part of my self-cleansing from Windows 8.1, I upgraded a stock Toshiba Ultrabook that I bought about a year ago – a moderately nice, thin device that I haul around in my travel rucksack whenever I need to take a Windows laptop alongside my usual MacBook Pro. It’s never been particularly great at running Windows 8.1, always feeling just a little bit underpowered; a seven-stone weakling, to misquote Charles



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@jonhoneyball

Atlas. Upgrading it to the current 10 build took a while – enough time to watch a full-length feature film – and the subsequent upgrade to the latest Fast-ring build took another Hollywood blockbuster’s worth. While I’d like to point the finger at the Toshiba, I’ve seen the same performance when running in a VM on my Mac Pro, which is hardly short of horsepower. Hopefully there’s something here that can be tuned to be significantly faster before product release.

The overall experience of Windows 10 on my Toshiba is much better than 8.1, feeling cleaner, more coherent and logical. All those nonsense Charms – and the other items that might have made some sense on a touch tablet – have disappeared when operating in Desktop mode on a proper laptop. Upgrading the Toshiba to Windows 10 has worked well overall, and I can’t imagine anyone currently on 8.1 wanting to stay there, given that Microsoft is making it free for home users to make the switch.

Business users will need to consider carefully how and when to upgrade as part of their upgrading and management process, but – while it’s rather tempting to suggest that anyone running Windows 7 in a business should stay with it for the time being, on the principle of “better the devil you know” – this time I’m going to stick my neck out and suggest that moving onto Windows 10 sooner rather than later will pay off. Don’t forget that despite all the desktop nonsense of 8 and 8.1, there was clearly a stronger and more secure core OS at its heart, and this continues with Windows 10.

The evolution of Internet Explorer is a rallying cry to developers: build to current web standards and do it now. We must put the horrors of Internet Explorer 6 firmly behind us. There are still far too many company intranets that run hack-o-matic HTML, and other bits of lash-up



**Jon Honeyball**

Opinion on Windows, Apple and everything in between – [p110](#)

**Paul Ockenden**

Unique insight into mobile and wireless tech – [p113](#)

**Olivia Whitcroft**

Practising solicitor specialising in IP and computer law – [p116](#)

**Davey Winder**

Keeping small businesses safe since 1997 – [p118](#)

**Steve Cassidy**

The wider vision on cloud and infrastructure – [p120](#)



code lurking around on company networks – a thorough cleansing is now well overdue.

Packet sizes

Here was a curious thing: my Mac Pro workstation was generally operating just fine, but couldn't connect reliably to a few specific websites; it didn't matter whether I was using Safari or Chrome, the problem remained. A Windows VM running on the same machine didn't have the issue, however, which was truly strange. It pointed to something in the base OS X operating system – but only on that machine, and not on others that had the same DHCP settings! It was particularly annoying because one of those sites was Adobe Creative Cloud, which meant that I couldn't update the Adobe software on this Mac Pro – every attempt to connect just resulted in a time-out.

It took some digging to unearth the answer. At some point, I'd manually overridden the MTU packet size value of 1,500 with a jumbo packet size of 9,000. I'd been playing around with some NAS boxes and experimenting with jumbo packets, then had of course forgotten to reset this value to the default. I should have done this experiment on a separate Ethernet interface, but

fiddling fever had gotten the better of me. Although everything worked on the LAN, and the firewall was happy enough to send out these fragmented packets, some website servers weren't so happy about handling them.

I'll confess I'm no expert on this level of TCP/IP plumbing, and nor should anyone need to be, unless they're involved in the careful tuning of large LANs. But it was interesting how almost every site was fine, apart from those few that didn't work. Returning the MTU size to normal resulted in immediate and solid connections to Adobe and all the others. As always, fiddling with these things is fine, provided you remember to undo what you've done: just because everything seems to be working doesn't mean you can neglect resetting everything. Sometimes I'm my own worst enemy – but at least I'll own up to it when it happens.

Cisco cloud stuff

On the subject of firewalls, I've been doing some rethinking at the office about our firewall and Wi-Fi infrastructures. We've tended to use Apple AirPort Extreme devices for a while, along with a few Netgears and some from other vendors. Especially when we're dealing with a leading-edge technology such as 802.11ac, there can be some odd interactions that can be traced back to the base station, and so having a few alternatives is often a good thing.

Apple's base stations are supposed to support up to 50 concurrent

devices, and the other vendors make similar claims. However, I'm somewhat sceptical about these claims. Get a dozen devices onto a Wi-Fi base station, even if they're doing minimal work, and you'll see all sorts of weird blocking, slowdowns, disconnects and so forth. This applies in the home environment, too. It's especially insidious there because you might have acquired a range of Wi-Fi-enabled devices such as cameras and smart TVs, and hence increased your connection count without really giving it much thought. The move towards the Internet of Things (IoT) will only make this problem worse, of course.

I've also become somewhat wary about firewalls. At the office we have a very expensive industrial-strength firewall, which was one of the few that was actually able to cope with a 100MB/sec in/out internet connection when I bought it around four years ago. Other vendors' kit, despite claiming adequate throughput, seemed to choke when given any real work to do. I pay an annual fee of several hundred pounds to receive the latest firmware for this device, and have to say that I do trust it. However, I can't shake off the fear that the toxic environment of today's internet is such that monthly or quarterly firmware updates don't cut the mustard any more, especially if they have to be applied manually. Surely we need something more proactive in this space?

After I'd talked to specialists in the field, it became clear that others are thinking the same, but have found the manageability of both Wi-Fi and firewalls to be a problem that increases almost geometrically with complexity. Most of these conversations seemed to come back to the Cisco Meraki range of products.

Meraki was acquired by Cisco a few years ago, and is notable for its cloud-managed devices: you get one dashboard for all your devices, presented in a clear and coherent fashion. All devices receive cloud-pushed updates, and configuration and management promise to be a breeze. Better still, there are useful capabilities such as simple site-to-site VPN tunnelling built in. I've ordered three of these firewalls for my three sites, and four of the Wi-Fi base stations. I've been promised that configuration of the real units will take only a few moments, and that management will be equally quick. If so, I'm really looking forward to them, because the current generation of

"Monthly or quarterly firmware updates don't cut the mustard any more"

traditional firewalls are almost, but not quite, as nasty to configure and manage as VoIP phones. They really do take the biscuit when it comes to sheer hostility. Next month I hope to update you about what happened, but it's already clear that a cloud-managed and controlled infrastructure such as that offered up by the Meraki range is the best way forward.

The prices aren't too horrendous; they're affordable even in the context of serious home networks. I think we place far too little weight on the real issues raised by home network routers and prefer to turn a blind eye to their security issues. I've raised this before, but industrial-strength firewalls – coupled with clean ease of use and management – should be more than just a pipe dream for home users. This is especially true if you're serious about IoT and having ever-more enabled devices arrive in your home.

Microsoft's Project Oxford

Praise is due to companies such as Microsoft and Google for opening up more and more capabilities to developers, especially in areas where it simply isn't possible to do anything equivalent yourself. Take a look at Microsoft's "Project Oxford", which is a collection of cloud-based technologies in the field of machine learning. Currently there are four main areas – Face, Speech, Computer Vision and Language Understanding. Taking these in turn, the Face APIs can take an image and work out where the human faces are in it, and also take a guess at whether those users are male or female. The system highlights the eyes, noses and mouths in the images that you load into it, and its success rate is very high.

Speech lets you convert text to speech in a natural-sounding way, and can also convert speech back to text. An additional advanced feature is converting speech to text with *intent*: in Microsoft's words: "This is similar to Speech Recognition. With Speech Intent Recognition, in addition to returning recognised text from audio input, the server returns



structured information about the incoming speech so that apps can easily parse the intent of the speaker, and subsequently drive further action."

Image APIs can do a range of things, including analysing an image to create properly adjusted thumbnails for it based on its content. In addition, it can provide sophisticated filtering to remove content such as pornography; it's used in the Content Moderator service to alert you to inappropriate imagery on your network, and even to work in the space of images of child exploitation. Finally, the Language Understanding Intelligent Service (LUIS) lets you use natural language within your applications, with commands tailored to your own needs. This can help Bing and Cortana to understand commands such as "set an alarm for 8am" or other items that may well be application-specific.

ABOVE Microsoft's Project Oxford includes a facial-recognition API

All these services are currently free, and you're encouraged by Microsoft to incorporate them into R&D work that you're building yourself. There's no indication yet of pricing for this technology, but I think it's fair to assume that if Microsoft does charge for it, the pricing will be vastly less than anything you could implement yourself using more traditional tools. These sorts of high-power cloud-based services are

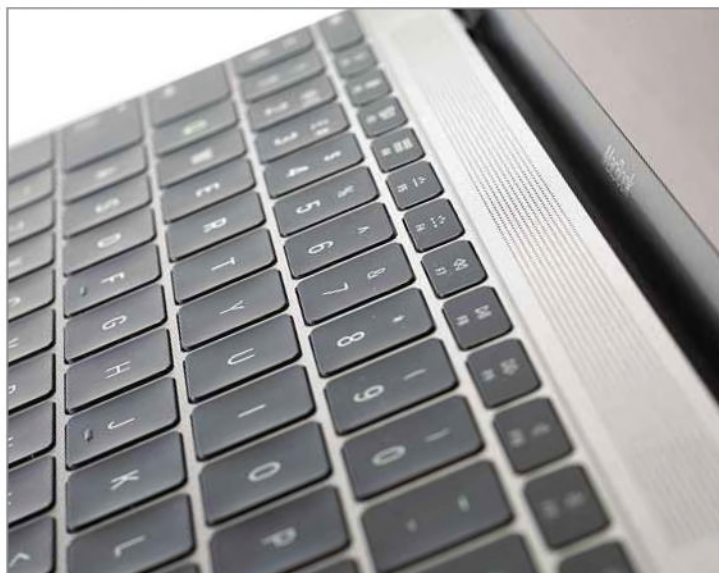
exactly where the cloud excels, and it's good to see Microsoft pushing forward with such capabilities for the wider developer community.

MacBook, USB Type-C and Thunderbolt

The new MacBook is intriguing me. I bought it to have a good poke around, to see what Apple had managed to do with its leading-edge engineering this time. There are some things about this product that I love: its thinness, its lightness and its display. The keyboard is a curate's egg: Apple has deliberately reduced the vertical movement of the keys on its keyboard, which could have resulted in a very odd action. I'll confess that it does feel rather strange, but it's more to my liking than I'd feared. That's because there's a clearly defined over-centre motion resistance to each keystroke, with a solid bottom end point. I can see that many people will not take well to this keyboard action at all, but I found myself typing away at high speed and with full confidence within a few minutes. While it isn't as good as a proper IBM-style desktop keyboard from the 1990s, almost nothing is.

The USB Type-C port really interested me, too, because Apple has never been shy about implementing new emerging standards – it was, after all, one of the first firms to put the original USB into a computer. With Type-C it has leapt in with both feet and remarkable confidence. I like the Type-C connector, which demonstrates exactly what's been wrong with USB up until now, and brings in the useful parts of Lightning too. Indeed, its data capabilities are such that it arguably eclipses both Lightning and Thunderbolt in one

BELOW Apple has reduced the vertical movement of the keys on the MacBook's keyboard, which feels rather odd



swoop, especially following Intel's announcement that Thunderbolt 3 will actually be a superset of USB Type-C. Finally, we have one plug that can do it all, and it's been better designed than the nonsense that is USB, and the issues of mini- and micro-USB, both of which are utterly hateful connectors.

The Type-C connector appears to be able to deliver huge amounts of power too, as well as bleeding-edge data rates for 5K monitors and the like, so I think we might be onto a winner here. However, the MacBook has only a single port, and it's normally used for battery charging. If you want to connect up a "legacy" USB device, you'll need to spend more money on an adapter. I'd have been impressed if Apple had bundled one of these with the MacBook for free, especially given the high price tag of even the basic MacBook. But no, it's an extra cost.

Of course, it's a brand-new world for Type-C devices, and things will change rapidly over the coming months. I think Apple has identified an interesting market for this new MacBook, namely people who want the lightness and portability of an iPad but with the power and flexibility of a real keyboard and full-power OS. I'm typing this on a new 13in MacBook Pro that I recently bought in New York, after unwisely setting off for a business trip without my normal laptop; while I love the power and connectivity of the MacBook Pro, the smaller and lighter form factor of the MacBook has a certain appeal. Does the MacBook set a new design reference for truly portable Ultrabooks, a new class of super-ultraportable? I think it does, and I suspect Apple will be walking away from the MacBook Air range soon. It did its job, but engineering has moved on.

One last thing – on the MacBook Pro 13, I find the screen size to be wrong for me, so I've been into the Settings app and changed the scaling from the default to the point between "Default" and "More Space". The screen is of high enough quality to support this, and the result is a better working space on the screen, more akin to a 15in display. Try it – it might work well for you too.

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PAUL OCKENDEN

"Imagine living in a house with a single light switch – one where all the lights go on and off together"

Such a system would be bonkers – so why do so many "smart" heating systems operate in this way? Honeywell offers something truly clever

This month, I'm mostly going to be writing about central heating. Don't worry, the printers haven't accidentally slipped a page from *Plumber's World* into your magazine – this is central heating with a hi-tech twist.

You've probably heard of Google's Nest thermostat, or the Hive system promoted by British Gas, both of which allow you to control your heating remotely from your smartphone. There are other players in this market, too: Tado, Inspire, Netatmo, PassivSystems – the list goes on, with new competitors popping up on the various crowdfunding sites on an almost weekly basis.

Most of these devices are designed to replace the traditional thermostat, and will usually supplement it with a little added intelligence, perhaps setting different temperatures at various times of the day, or allowing you to turn the heating on and off from your phone while you're out and about. Some will even "learn" how you live your life and start adjusting the stored schedule to match this.

Truth be told, I'm not a great fan of such learning systems. If your life is fairly structured, it's easy to create a schedule to match, but a learning system won't stand a chance if you're more chaotic – if you take a couple of days off work, for example, it will think that's your new daily routine.

I much prefer a system where you can override a fixed weekly pattern for specific events such as bank holidays, sick days and the odd week away – perhaps with added automation to cope with exceptionally hot or cold days, and maybe some geofencing so that you don't heat an empty house but always return to a warm one.

All the systems I've listed have one thing in common. As with traditional heating



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thermostats, there's a single controller, with one thermostat covering your whole house. Just think about that for a moment. Can you imagine living in a house with a single light switch? One where all the lights go on and off together?

For starters, it would be an incredible waste of energy – you'd be lighting rooms that weren't in use. It would also be uncomfortable, since the person cooking in the kitchen under bright lights would inconvenience those trying to watch TV in the dimly lit living room or sleeping off a migraine in a blacked-out bedroom. A single light control would be bonkers, so why are we prepared to put up with a single control for our heating systems?

Okay, thermostatic radiator valves (TRVs) can help, but they just set a target temperature for each room; they have no idea whether that room will be occupied at certain times of the day, or on certain days of the week. If you want your bedroom to be nice and toasty when you get out of bed in the morning, a TRV will keep it at that temperature all day. We spend a fortune on energy-saving light bulbs to reduce our electricity bills, but lighting accounts for less than 10% of the energy costs in a typical house.

BELOW The Evohome controller is the heart of the heating system



Heating and hot water usually make up more than 80% of the bill, so surely that's where we need to look for improvements and make savings.

In the zone

The best way to achieve this is through zoning: that is, splitting your home into separate areas so that each has its own heating schedule. Some upmarket homes come with such systems in place, with valves near the boiler opening and closing as required to heat different zones. If you live in a more traditional house, however, perhaps with an ancient boiler and hot-water setup, it's possible to retrofit a zoning system. Usually this works by replacing all your radiator valves with intelligent controllers, so that various "setpoint" temperatures can be sent to each device at different times of the day.

There are several such systems on the market, although many suffer small niggles that work against them. Some require a wired connection to every radiator valve, which is bonkers in this day and age. Others employ one-way communication from a central controller to their radiator controls, simply sending the setpoint temperature. The problem here is that the system doesn't know when the whole house is up to temperature and all of the valves have closed, so the boiler continues to churn away wastefully.

After a lot of research, the system I eventually chose for my own house was Evohome from Honeywell. This consists of a central controller device and others that you fit to each radiator, plus a few optional bits and bobs.

Why did I choose Evohome over the other systems? Well, mainly because it's a mature system. The Evohome controller is now into its third generation – although it's actually older than that, since its roots lie in an earlier system called Hometronic. Even Honeywell's radiator controllers are now second-generation, whereas newer competitors are very much version 1.0, with the associated problems that version 1.0 devices suffer.

The Evohome controller is at the heart of the system. It talks wirelessly at 868MHz to all the other components. These can be sensors

(such as thermometers) or actuators (such as relays, and valves that turn radiators on and off). Some devices contain both: as well as turning radiators on and off, the TRVs also contain a temperature sensor.

The communication between most nodes is two-way, which is important for two reasons. First, it means that local changes on any TRV or room thermostat will be reported back to the Evohome controller. Second, devices can report their demand for heat, so the boiler need only fire up if at least one radiator (or other heat source) is calling for it. Evohome is therefore ideally suited to older properties with old-fashioned boilers and radiators, although it can also cope with underfloor heating and electric heat sources. If you have a system with a stored hot-water tank heated indirectly by your boiler, it can even control that.

Let's take a more detailed look at each of the components of this system. The controller is a 140 x 100mm box with a 4.25in colour touchscreen. This allows you to view and control the temperature of every zone (you can put several rooms into the same zone) and your hot water too. Different target temperatures can be set for various times of each day. And you can override the temperature in any zone, and several "quick actions" are available to turn down the whole house by a few degrees, for example, or set the system into "working from home" mode, where it treats a weekday as though it were a weekend.

There are two mounting options available for the controller: there's a tabletop stand, or you can attach it to a wall. It contains a rechargeable battery, so the unit can be removed from the wall or table for short periods, but it will start to beep at you if you keep it away from the mains supply for too long.

Until recently, controlling your heating and hot water via an app on your smartphone or tablet required an Internet Gateway Device that connected to your broadband router. However, the latest version of the Evohome

controller no longer requires this gateway; it talks to your router via Wi-Fi.

The smartphone and tablet apps largely mirror the facilities available via the Evohome controller, although they don't talk directly to the device – everything goes via a US-based cloud service. In addition, APIs are available that let you write scripts to monitor and graph the temperature in the various rooms of your

home, and even control those temperatures. (I'll cover how to do this in a future column.)

You'll need to control the heat source in each room – in most cases, a radiator – by using HR92 controllers. If you already have thermostatic radiator valves, you can simply remove their existing heads and replace them with the HR92. Most brands of TRV are supported, although a few will require an adapter.

The HR92 senses the temperature in the room – it's designed to measure the temperature of the updraft that occurs around the edge of a room – and tries to maintain the set temperature by opening its valve proportionally, not just on or off, and demanding heat from the boiler if needed (more on that in a moment). There's a large LCD panel on each HR92 that displays the current set temperature for that

zone; you can change this to show the room temperature instead. A rotary dial lets you override the temperature set by the Evohome controller; such local adjustments will apply until the next scheduled temperature change.

I've been impressed by how well isolated the temperature sensing of these HR92s appears to be, considering they're attached to hot pipes and sit next to huge heaters. Even when a radiator is extremely hot, the white body of the device seems to remain at room temperature.

Also impressive is their battery life: despite all the mechanical opening and closing, RF comms and LCD-panel updates, two standard AA alkaline batteries will last around two years (you'll receive a notification on the Evohome controller when they need to be replaced). If you have underfloor or electric heating, there are other options available, but since I have neither I can't comment on them in a real-world sense.

BELOW The Evohome app gives you full control of your heating while out and about



"Heating and hot water make up more than 80% of the energy bill, so surely that's where we need to look for improvements and make savings"

Multiple sources

You might have multiple heat sources within a zone, and Evohome provides some flexibility with regards to how these are treated. Each can work in isolation, or one radiator (or other sensor) can become a master, controlling all the radiators and other heaters. The latter is the default behaviour, and it sometimes works better if you have an open-plan space or one large room with several radiators. The former scheme is designed for a single zone that consists of multiple rooms. Having played with both, I reckon that, even for large, open spaces, the multiroom option usually works better.

In situations where you have a radiator behind a sofa or a bed, say, or in a radiator cabinet, the sensor in the HR92 won't give you a true reflection of the room temperature. In this case, it's worth mounting an external sensor in that room.

There are two main options and, as with the radiator controllers, they're wireless. There's a stylish, round, wall-mounted thermostat called the Y87RF and a more utilitarian-looking device known as the DT92E. Both have fairly large screens that display the current room temperature. With the Y87RF, you can adjust the zone temperature up or down by rotating a large bezel around its display, while the DT92E employs more conventional push buttons. In fact, it goes two steps further than its more stylish cousin

by offering an "eco" button, which you can push to change the temperature of the zone for a number of hours (this is performed independently of the eco settings available on the Evohome controller), and a button to switch off the whole zone.

Another advantage the DT92E has over the Y87RF is that it comes with a table stand as well as a wall mount, whereas the Y87RF is wall-mount only (it comes with screws and Rawlplugs in the box, but I've found that VHB tape works really well too). If you're the kind of person who likes to fiddle, the DT92E is probably your best bet, but if you want something that looks stylish on the wall then I'd recommend the Y87RF.

When it comes to how the system interacts with the boiler, there are a few options. My house has what's known as an S Plan heating and hot-water system, in which there are separate motorised valves for the heating and hot-water circuits; a feed from each of them fires up the boiler once its valve is fully open. With a conventional central-heating controller, a time clock and a room thermostat would drive these valves.

When retrofitting Evohome, you'll bypass the clock and thermostat and feed power to the two-way valves via a small wall-mounted relay box known as a BDR91. This is a receiver that takes commands from the Evohome controller whenever heat from the boiler is needed, either to heat a room or for hot water. (Incidentally, the temperature of the hot-water tank is sensed using yet another battery-powered wireless sensor.)

I have 14 radiator valves in my house, plus both types of room stat, a hot-water sensor, two BDR91s and the Evohome controller itself. You'd think this would cause a lot of RF energy to fly around, and that there would be either interference or collisions, but this isn't the case. The RF side of things has been designed to work on the 1% principle – 1% communication, 99% silence – and the timings of the various devices are staggered so that there's never any noticeable wireless



ABOVE The Y87RF is a stylish, wall-mounted thermostat

“Even if you ignore the economics, the big thing for me is comfort; as a result of Evohome, the whole house feels far more comfortable”

congestion. I've watched these comms using my trusty RF Explorer (as described in several previous columns), and they all seem to occur quickly.

So, the big question: is it worth it? Fitting an Evohome system isn't cheap, but neither are fuel prices. Honeywell reckons the system will typically save you around 40% on your fuel bills. It's too soon to

know whether or not this is accurate in my case, but the boiler definitely isn't firing up as often, or for as long, as it used to. Plus, I'm not heating unused rooms, so I'd expect the payback time to be quite rapid.

Even if you ignore the economics, the big thing for me is comfort. With my old system, a radiator would either be going at full blast or stone-cold, and room temperatures would cycle too. As you walked around the house, there would be pockets that were too warm or too cold. Evohome has changed all of this. Radiators are now warm – just warm enough to hold each room at the temperature requested – and there's no more noticeable heating up and cooling down as the heating cycles on and off. Because of this smoother control, I'm able to set a lower temperature than before, knowing it will never fall below this level. As a result, the whole house feels far more comfortable.

My system was installed by an accredited installer, but there are places online such as The Evohome Shop ([pcpro.link/251mw](https://www.pcpro.link/251mw)) that will sell you the bits if you want to install the system yourself. There's no plumbing involved, unless you don't already have TRVs. You might need a sparky to wire up the BDR91s if you're scared of electricity, though. I'd recommend an installer, but make sure you quiz them on how many similar systems they've fitted, since Evohome is relatively new.

Over the coming months, I'll report on how my system is working, as well as covering how to extract and chart data, and the additional levels of control available by interfacing with third-party apps and systems.

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LEFT The HR92 will replace the head on most thermostatic radiator valves

OLIVIA WHITCROFT

“If terms are far removed from reality, then this defeats the purpose of having a written agreement at all”

As new technology inspires creative services, customers and suppliers also need to be creative with the terms of the contracts between them

Picture the scene: it's 1993 and the forward-thinking telecommunications manager at Big Industry Ltd has decided that this new-fangled email communication will be good for business. He clears it with the operations director and before long they've decided upon a provider.

Initially, email will be set up on one PC for one user, but if all goes well, the intention is to roll it out across other company computers. Practicalities such as phone lines and modems are discussed, fees and setup dates agreed, and then the small matter of a contract is raised. The company requires all providers to sign up to its standard terms, and it's explained to the provider that a few additional provisions are required for these types of services, including responsibilities for the BT line and so on. The contract is drawn up and sent (by post) to the provider for review.

Casting his eye over the document, the provider soon realises that he's been presented with a contract for fax-machine maintenance, complete with response times for fixing hardware faults, paper and ink-cartridge replacement. He raises these concerns with Big Industry and is told that it will accept a few tweaks, but there's no time for lengthy negotiations or for a new contract to be drawn up. The provider signs the contract and the parties move forth into the unknown territory of providing email within a framework of fixing fax machines.

This isn't a true story, but it represents the frequent disconnect between the terms of technology contracts and the services that are being provided. This is emphasised by the rapid development of technology, presenting new environments



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for delivering services and new opportunities for business collaborations. Insufficient time and resources are allocated to producing a bespoke contract, so providers are presented with “standard” terms. These are generally used for more established methods of service delivery, but are felt most appropriate to match the context. They range from something slightly inappropriate to complete nonsense: as in my example above, it really can be the difference between provision of email services and fax-machine maintenance.

More up-to-date examples include contracts for face-to-face or web delivery of services, where in reality they're being provided over a mobile app; or end-user agreements for technology services, where in practice the services are being resold. Software development agreements often don't reflect intended use of source code or copyright. Contracts involving use of customer data are frequently unsuitable: terms requiring a party only to process data upon instruction, when it's clearly taking action under its own steam; promises to keep data on a fixed server in the UK, when it's actually being entrusted to a subcontracted cloud provider.

BELOW Check those Ts&Cs carefully before you sign a cloud contract, because who knows where your data will be stored?



If terms are far removed from reality, then this defeats the purpose of having a written agreement at all. The point is to document how the relationship is intended to work, which may act as a guide to the parties' actions (such as delivery of services and payment), protect certain assets (such as copyright and know-how) and give a clear basis for legal recourse in the event that something goes wrong. Inappropriate terms may fail to achieve any of these. The most they may do is meet internal administrative requirements.

So what?

Of course, the parties may carry on their relationship in harmony regardless of the written terms. So, all may be well. However, sooner or later, one party may want something to be done or may dislike something that the other party has done, and will refer to the agreement. At this point they'll discover that the terms say something different, haven't covered the issue, or don't really make sense.

Both parties could then agree to amend the contract to fix the problem, or find a practical way forward, and this may resolve matters. However, if they remain in disagreement, they'll want to rely on the existing terms to protect or defend their position. Unfortunately, the legal position with those terms may be extremely hazy!

Taking one extreme, the agreement may be enforceable as it stands; in other words, the parties will need to comply with the terms as written, even though they both had something else in mind. This may happen where the contract is disadvantageous for a party, but isn't too far from the core intention. At the other extreme, the agreement may be ineffective due to a mistake or lack of certainty. This is generally unhelpful for both parties, but may result in one side being put at a greater disadvantage.

Where possible, a court will try to construe the wording of a contract in a way the parties intended, or may infer terms to give effect to that intention. Or, if a party can show there's been a mistake, a court could order the contract to be rectified. This could help, for example, if the word “fax” was used instead of “email” and it's clear the parties meant “email”. However, giving new meaning to the terms is unlikely if the terms can reasonably be given their ordinary meaning, or if they're far removed from reality; a party is unlikely to provide evidence of completely different terms having been agreed.

Unsuitable terms can also cause compliance problems or have knock-on effects on other relationships. For example, it can be a breach of data-protection law not to impose security obligations on a service provider, and ineffective assignments of copyright may mean intended onward licences to others are ineffective.

As can be seen, resolving the consequences of inappropriate terms can be time-consuming and costly, and even then may not achieve the desired result for either party. It's much better to get the terms right from the start.

What can be done about it?

The overall message isn't new: a contract needs to be tailored to the context of the intended relationship. As new technology inspires creative services and methods of service delivery, customers and suppliers also need to be creative with the terms governing their relationships. Standard terms can be useful for the basics, but bashing out terms to apply unamended to all technological scenarios is unlikely to be achievable.

The argument against this approach also isn't new. Getting external lawyers involved can be costly; getting in-house lawyers involved for each project can be time-consuming. Standard terms and procedures help to keep control of legal risks within the available resources and budget. Each new relationship may not justify the time and costs involved in producing a "perfect" contract.

However, this doesn't mean that a middle ground can't be reached, showing some flexibility in approach. If time and resources are limited, a shorter agreement may be an option, with a clear description of the intended relationship, but without addressing every scenario. This is likely to be better than a mesh of terms that sound good legally but are potentially useless in practice. A more all-encompassing agreement could then be produced at a later date if things go well.

If terms are added to address a new technological issue, remember also to adapt the terms that are already in there. The repeated addition of new layers of terms often results in overly



complex contracts. For example, new terms may be added relating to online delivery of digital content without removing terms about physical delivery. The intentions may be good but, before long, the simplest route forward may be to rip up the contract and find a blank piece of paper to start again.

Effective communication can also reduce the time involved in getting the terms right. This includes input from those who understand the technology, and appropriate lawyer-to-lawyer discussions. It may sound crazy, but contracts aren't just for the lawyers – the terms should ideally be read and understood by commercial and technical teams as well.

What happened next

Let's pick up our story from where we left it in the early 1990s, with Big Industry starting to use email. There soon followed business networks and websites, and into the late 1990s e-commerce became the big thing. Search engines became sophisticated, websites started to interact with customers, and digital content became an alternative to physical equivalents. Employees were becoming more mobile; laptops replaced desktops, mobile phones were standard issue, and they could dial up to the work network from home. Psions and PalmPilots went into pockets or handbags. The "tele" was slashed from the telecommunications manager's job title.

In the noughties, dial-up was soon replaced by broadband, and PDAs by

BlackBerrys to access email on the move. Pretty soon competitors had arrived on the scene offering smartphones and tablets. Moving into the current decade: VoIP, webinars and social media became established business tools; apps started to challenge websites and other traditional methods of service delivery.

Alongside all this, IT services and licensing models were changing. Software downloads were superseding floppy disks and CD-ROMs, and open source was added to the mix in development projects. Alternatives to traditional IT outsourcing were evolving, moving through application service providers and reaching cloud computing in the 2010s. Infrastructure-, platform- and software-as-a-service started being provided using intricate partnership and subcontracting models.

Just over 20 years down the line from introducing email, Big Industry is now looking into BYOD, Big Data, the Internet of Things, 3D printing and augmented reality. Big Industry's relationships with its providers and partners continue to evolve to capture these new opportunities. All it has to do is ensure that its contracts with these parties continue to evolve as well.

If all you have is standard terms, everything looks like a fax machine.

"Contracts aren't just for lawyers – the terms should be read and understood by commercial and technical teams as well"

The above commentary provides general information on the subject matter and is not intended to be relied upon as legal advice.

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DAVEY WINDER

“Security that isn’t implemented, or isn’t implemented properly, is as much use as a chocolate padlock”

However, the solution needn’t be complex or expensive. The credit-card-sized Qwertycard may be all you need

For the longest time, the advice was never to write down passwords. There was good reason for this, namely that the key to your network was often found dangling from your monitor on a sticky note. Then things changed, and everything needed a password – so many passwords, in fact, that for many small businesses their security options lay somewhere between “one ring to rule them all” and “write them all down”. The former often took the form of a password vault, in which your written-down passwords are encrypted and stored in a file that requires you to remember only one super-strong password to open it.

I said “somewhere between” there, because two problems arise from this multiple-password mess we find ourselves in today. First, there’s the temptation to cut down on the number by sharing the same passwords between several sites and services, the consequences of which are obvious and oft-exploited – an attacker who compromises one login has a good chance of compromising the others too.

Second, and perhaps a little less obviously, many users of password-management vaults soon find themselves back in Post-it note land. This means there’s still a chance someone could find that sticky, connect it to your vault file and hence gain access to everything. However, in the modern working age it appears to be the best option.

There is a third way. You can keep multiple passwords – the “something I know” in the theoretically perfect identity-authentication formula – but add an extra layer of “something I have”, which is how two-factor authentication (2FA) works.

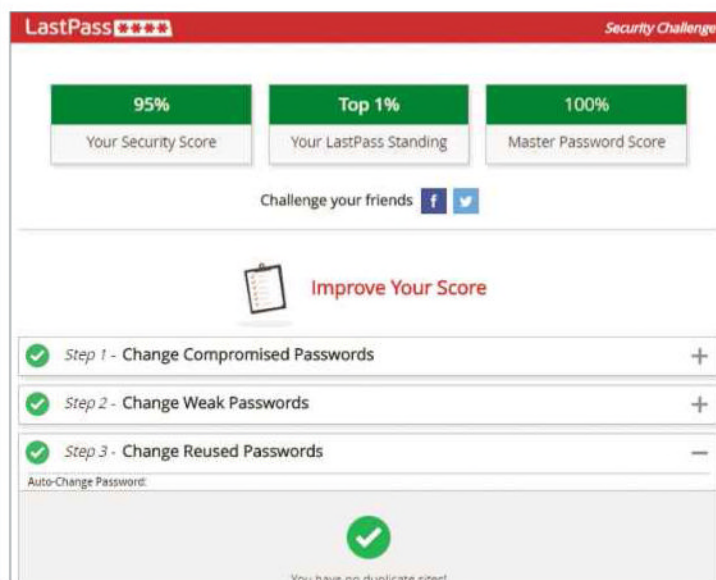


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This requires not only a master password to achieve stage one, but also a token to complete stage two: that token could be in the form of a code sent to your mobile phone via text message or one created by an app. Or, it could be a physical token that generates a one-use code on the fly when plugged into your machine.

For some time now I’ve recommended to both consumers and small-business users that a combination of password-vault management and 2FA is the way forward. I have first-hand experience of small-business clients whose data integrity has been preserved by the adoption of 2FA security following the breach of a third-party service. Unfortunately, not all third-party services will offer 2FA. In fact, scrap that, not all the services you use that are password-protected will offer 2FA. And while I remain convinced that, where 2FA is available, it’s common sense to employ it, where it isn’t available I’m going to rip up the rulebook and go all old school with some contradictory advice: write your password down. Not only that, but keep it with you in plain sight so you don’t forget it.

BELOW Does your password reuse pass the acceptable security test?



While I have you totally confused I’ll also thrown in this extra corker: reuse the same password across all your logins. Of course, all this isn’t as chaotic and insecure as it may first appear, and I most certainly haven’t lost the plot; instead I’ve found a remarkably simple and elegant solution to one part of the secure-password puzzle, called Qwertycard ([qwertycards.com](#)).

In the world of security, the paradox rules supreme. You might think that the more complex and ingenious the solution the more secure it will be, but that doesn’t allow for the fact that if the person using it finds it time-consuming, confusing or overly expensive then it’s less likely to get used. Security that isn’t implemented, or isn’t implemented properly, is about as much use as a chocolate padlock.

Qwertycard recognises this and turns the security proposal on its head, making it as simple as it can be. It’s a credit-card-sized item that slips into your wallet/purse and has your password printed on it in a way that can’t be deciphered by anyone other than you.

The Qwertycard is well named: it comes in the form of a printed black card with a white Qwerty keyboard on it. Below the keyboard is a spacebar on which you’ll find printed some random characters. And that’s it, apart from the seemingly counter-intuitive (when it comes to security) instructions printed on the reverse: “space bar code + your secret + site name”.

The spacebar code contains at least one number, one lower-case letter, one upper-case letter and one non-alphanumeric character to

ensure all Qwertycard passwords meet the minimum criteria across most sites and services. This code is the first thing you’d type when entering a password into an online service, exactly as it is printed on the card. So in the screenshot (see *opposite*) that code would be wKjH!oSY, which isn’t the easiest string of characters to remember, and that’s the point. It contains random character combinations that make it harder to crack than dictionary words or supposedly random words that aren’t: most random

words you come up with won't be truly random, whereas this one is created using a random code generator to do a slightly better job.

The people behind Qwertycard selected code characters from 80 of the characters found on a standard keyboard, excluding a small number considered to look too similar or potentially confusing for users. Obviously, every Qwertycard has a unique spacebar code printed on it, and the digital versions of both data and codes are securely erased as soon as the card itself has been physically printed. What's more, I'm assured that no record is kept anywhere to link each customer's order to the cards that were shipped to them. Instead, every card is shipped with a covering letter that contains the only copy of its Qwertycard code as a backup – and hence a potential weak point in the password security chain; you must store this securely (my inner cynic wants to suggest a password vault would be a good place).

Code creation

Okay, putting irony to one side for now, let's move on to the next part of your Qwertycard password-creation system, namely your secret word. This is something that only you know; you can make it as long as you like. It doesn't need to be overly complex or composed of special characters, upper- and lower-case and so on, although once again the security geek in me wants to suggest that it would make sense to create it in that format. Not least because it's just this one word, so if you keep its complexity simple (if you see what I mean) it will increase the overall strength of the passwords you end up creating.

So, for example, instead of using "JeanClaude" as your secret word (that's the name of my van in case you're interested) you might use "Je@nCl@ude". That's no more difficult to remember once you have it in your head, but as part of a more complex character string it makes cracking the whole thing much harder. Make your secret word something that isn't easily guessed, though; here the name of my prized work probably isn't a great choice!

If you want to be sneaky with your secret word, why not encode the word using the Qwertycard itself, as you must do with the site name? "JeanClaude" would then become "lq,6GS,6pq". This word is then used as the middle part of all your passwords, which still makes Qwertycard appear pretty insecure



when you consider that it's now using something printed on the card itself plus a word that's shared across every site or service you use.

The final piece of the code-creation jigsaw may not seem to add much to the security either, since it's just a code created by the cipher keyboard visible on the card. However, cards come with different ciphers and the site name you choose doesn't have to be an obvious one. So instead of using "eBay" to create a code of "q5,6", you could use "Auction", which gives "6goVP6". I wouldn't get too paranoid, since this part of the password system is really just to ensure that you have truly unique passwords for each service, to prevent online attackers from easily guessing them. Once you have all three parts of a password in place it becomes both complex and strong, yet at the same time easy to use and remember.

Qwertycard is cheap – at £5 per card – and safe enough, when used properly, to increase security wherever 2FA isn't an option. Even where 2FA is available, Qwertycard provides a low-rent yet secure method to both create and remember complex passwords.

I'm not going as far as to suggest that Qwertycard is the holy grail of consumer/small-business security. It patently isn't, and there are some

ABOVE Qwertycard, the new old-school way to protect passwords by writing them down

"Qwertycard provides a low-rent yet secure method to both create and remember complex passwords"

rather obvious weaknesses. The three biggest are: it reveals part of your password, which makes it less work for someone to crack the remainder; it creates more work if you ever need to change your password, whether following a security breach or for housekeeping purposes; and some websites disallow certain characters that the Qwertycard will want to use.

Of all these, the last is my biggest concern. After all, the success of Qwertycard hinges largely on its ability to generate complexity without making the user experience too nasty, so anything that diminishes both at once

needs to be taken seriously. As a pragmatic workaround, the folk behind Qwertycard suggest that you manually substitute allowed characters (normal alphanumeric ones) for the disallowed ones for those sites only. This does deal with the usability issue, but at the cost of complexity. Thankfully, fewer and fewer sites are imposing insecure restrictions over character types and password lengths, so this may soon become a problem of the past.

The password length will vary, depending upon your secret word and the site name you use – as will its randomness – but typically you're going to be looking at a password string in the region of 20 characters or more. And what if you need to change a site's password regularly? Again, there's no ideal solution, only another workaround, namely to add the month in a three-letter format, encoded of course, to your secret word. This wouldn't show the month in plain text, so if a password were compromised on the site, it wouldn't be obvious what you were doing.

As an honorary Yorkshireman, I feel compelled to throw in that you could print your own version of a Qwertycard for next to nothing. When I spoke about Qwertycard to a local small business – and by small I mean fewer than six employees – they

Continued from previous page

could see its benefits, but were put off by the perceived complexity of managing it at their own business level (where their IT department is a woman called Shirley who opens the mail and also makes the tea). A valid concern, although the cards are so easy to understand and implement that staff “training” is a doddle.

Management can be as simple as keeping those master letters stored securely, although a better option would be to scan them and then burn them, keeping the digital versions in an encrypted format, enabling some onwards management capability if the “secret word” is added. Of course, Qwertycard’s model isn’t really aimed at the serious end of the business market, and nor would you expect it to be, but as a partial solution to many of the problems I’m seeing in the real world at a more macro-business level it surely deserves some serious consideration.

My Little Google

Google comes in for a fair bit of stick. The social media world accuses it of not really being a serious player with Google+, and those on the more accusatory side of the privacy debate regard it as something of a Data Dyson, sucking up all the information it can about everybody and everything.

For once, though, I won’t be beating Google with its own “don’t be evil” commandment, but rather applauding it for following Facebook’s lead. How so? Well Facebook has faced up to its privacy critics by introducing a central security settings interface, where everything privacy- and security-related can be configured. Now Google has caught up, with its “My Google Account” interface. It’s early days yet, but a quick play with the control panel suggests that it’s a big step forward in security strength. The inclusion of privacy and security checkup systems, with step-by-step guides that handhold you through their options, is a real advance and one I suggest that everyone, no matter how secure they think they are, should take.

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STEVE CASSIDY

“How many of the world’s top 500 fastest computing facilities are Cray shops? (Answer: 28%)”

The British Met Office has just placed an order worth \$100m with the company – are the services of this supercomputing veteran worth it?

What would you pay for a Cray supercomputer, today? Yes, that would have been a silly headline, but hear me out. I appear to have attracted the attention of the supercomputing crowd after writing about my encounters with IBM’s Watson and the Dell/Cambridge University monsters of computing, which led to an invitation to the offices of Cray Inc (founded 1972).

The firm is presently located in the smoking-hot tech hub that is Bristol, and it’s not only there to churn out racks full of standard components with vinyl stickers covering their standard tin. This is Cray Computers, dammit, the inheritor of Seymour Cray’s mighty brand and pioneering attitude to very high-performance computing. The firm was only too pleased to make a proper splash when opening this new UK office, which isn’t here only to support the recent (and impressively pricey) purchase of \$100 million’s worth of kit by the British Met Office. No, Cray has development and implementation projects running out of Bristol in which American staff take orders from British global project leaders.

Whoa, headspin moment – this definitely is *not* a PC company. Cray’s roots stretch back to the early 1970s, when it created the key inventions and algorithms that made supercomputing viable, and which still give it an edge today. These aren’t like my friends in the Fens, who distribute racks of top-end supermicros that can be built into supercomputers. This isn’t a hot startup that stuffs all your data in the cloud and mumbles about scale-up versus scale-out – Cray’s president, Peter Ungaro, dismissed my cloud questions as quickly as he could



Steve is a consultant who specialises in networks, cloud, HR and upsetting the corporate apple cart
[@stardotpro](https://twitter.com/stardotpro)

without being rude. He knows that for real supercomputing you keep the brains and the storage close, linked by the fastest communication fabrics; you don’t leave them dangling at the end of dubious, inconsistent internet pipes. His interest lies in how many of the world’s top 500 fastest computing facilities are Cray shops (answer: 28%). Nowadays, quite a few of these top 500 are evangelising a “build it yourself from plain white boxes” approach, but Peter and his team are quite clear about what buying Cray adds to that basic, building-blocks outlook.

If you need to know how much such machines cost, the answer is that you probably can’t afford one – prices start at half a million dollars. Now I’m going to forswear the usual attempt to crunch such huge numbers down to the everyday scale, but I’ll just mention that last time I saw someone put together a “white box” commodity supercomputing environment, comprising two fairly full racks, they paid just over £300,000; you don’t need to be a red-braces City type to see that \$500,000 and £300,000 are actually quite close, allowing for the exchange rate.

The basic Cray is a rapidly mutating beast, but I just managed to grab a fleeting reference on one of the firm’s slides to “Haswell”, which pegs these boxes as being out of last year’s Intel parts catalogue. That passing moment made it sound as if “Cray” was just a sticker, using the same chips everybody else has in their far cheaper platforms. (I did notice stickers on the lids of the entirely standard laptops visible on the Cray office desks, which read “My other computer is a Cray” – and no, I didn’t manage to snaffle one.)

Now I realise there are lots of folk who fervently, even obsessively, believe that the cheapest and most straightforward server designs are just as fast and long-lived as the machines made by their more ambitiously priced competitors.

BELOW Peter Ungaro, CEO of Cray, quickly dismissed my questions on cloud computing





I'm reminded of cheery blogs from the early days of Linux in academic institutions that showed dumpsters full of retired "Windoze" workstations being reincarnated as bizarre (but very fast) Beowulf clusters of mismatched bits. I'm sure this kind of experiment has been repeated several times, with the final results being trumpeted as victories for penniless geniuses who need to run some vast compute-pool task – and, while they're at it, to take side-swipes at the massive inefficiency of the Windoze environment.

However, when I watched a real supercomputer being specified, ordered, built up and run, the relationship between this and "commodity" hardware (stuff I could grab online in a few minutes and expect delivered the same week) was tenuous to say the least. If you stretch the definition of "commodity" to include precisely matched, leading-edge, fully populated rack-dense machines interlinked by state-of-the-art InfiniBand crossbar interconnects, then I suppose this is commodity of a kind.

This stuff had to come all the way from Japan, and had very grumpy requirements for such things as IP address ranges and access to the internet – none of which I'm used to seeing even with enterprise-grade machines operating as compute servers, never mind commodity-grade ones.

Cray struggled with my questions about this. Mr Ungaro was polite, but was clearly distracted by the non-technical mission of making The Hon Edward Henry Butler Vaizey MP, HM Minister for Culture, Communications and Creative Industries – alongside local Bristol dignitaries – feel welcome. The Rt Hon Ed's speech was great fun, actually, very much in the Boris style, but it wasn't really about anything technical; more about how lovely Bristol is as a place to set up

your hi-tech business. It also gave me a good 15–20 minutes to look around the room and figure out what I was seeing, and hence formulate some more apposite questions – once the painful business of tape-cutting and standing holding the strip of the local football team had come to an end. No, I didn't understand that bit either.

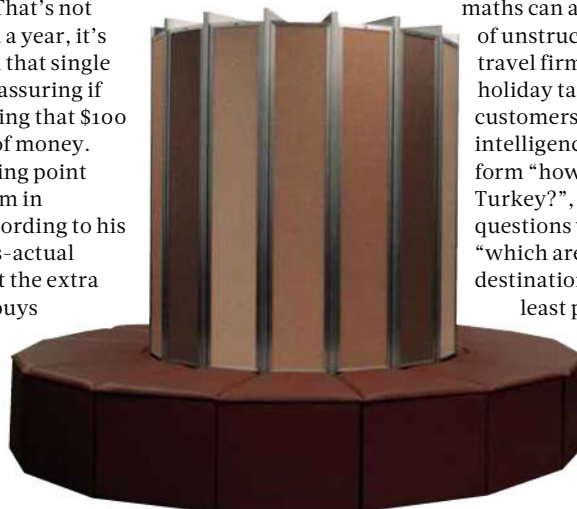
Things became more technical in direct proportion to the degree of relaxation and the amount of champagne consumed: the Met Office chaps talked about their \$100 million order, although, once again, this was more about "what it does" than "how it does it". I know from a previous life hanging around the edges of the insurance business that there's a huge market for more accurate weather forecasts from business users – farmers are merely the tip of this iceberg. The Met Office boss pointed out that in a single severe weather event – those St Jude's Day storms that I remember clearly – the money saved by emergency services by being in the right places (and not the wrong ones, such as near the sea, or on top of a hill), and by various commercial operators not sending out trucks to suffer nasty weather-related crashes, was already enough to pay for this new machine. That's not money saved in a year, it's money saved in that single event – most reassuring if you were thinking that \$100 million is a lot of money.

The interesting point about this \$100m in particular – according to his forecast-versus-actual graphic – is that the extra horsepower it buys makes today's three-day forecast as accurate as a one-day forecast of around ten

ABOVE Cray's XC40 is powered by Intel Xeon CPUs – but is a world removed from a regular server

"The more calculations he can cram into the interval between a buoy bobbing up and down and rain smacking my windowpane, the more accurate his warnings will become"

BELOW The classic Cray X-MP/48: an iconic supercomputer design



years ago. So in this very specific field I have an equally narrow answer to that question with which I started the column: he'd pay whatever they ask for this Cray computer, and for the next one, because the more calculations he can cram into the interval between a buoy bobbing up and down and rain smacking my windowpane, the more accurate his weather warnings will become.

But why go to Cray – a company with traceable chunks of intellectual property that date back to 1972 – to spend such cash? If you're just crunching petaflops, then you could simply sit down with a spreadsheet and a parts catalogue and build your own, right? Anything else would just be the Apple Tax writ larger, money grabbed from people not smart enough to get the same thing for less...

Er, not quite. First of all, the building-blocks method of buying commodities rests heavily on an assumption that there are no bottlenecks in the architecture, and no limits to the ability to compute. This is an assumption I've seen manifestly disproved many times over, even before straying into supercomputer land. I also started to recognise a common theme from all the case studies that the Cray guys and their assembled customers offered: it's all about vectors or, in more modern cases, graph theory.

I'm not aiming to summarise this entire branch of mathematics, but I'd just like to point out a very subtle distinction between looking for a shape you already know is in a picture and letting that shape make itself known to you. Sound almost mystical? Well, here's one perfectly mundane example of how this kind of maths can achieve results from a pool of unstructured data. A particular travel firm had a database of every holiday taken by its German customers. A traditional business-intelligence question may take the form "how many people went to Turkey?", but vector-orientated questions would be more like "which are the fastest-growing destinations?" or "which are the least popular airports?" Graph

theory allows data to present emergent behaviours or properties with minimum presumptions on the part of the questioner.

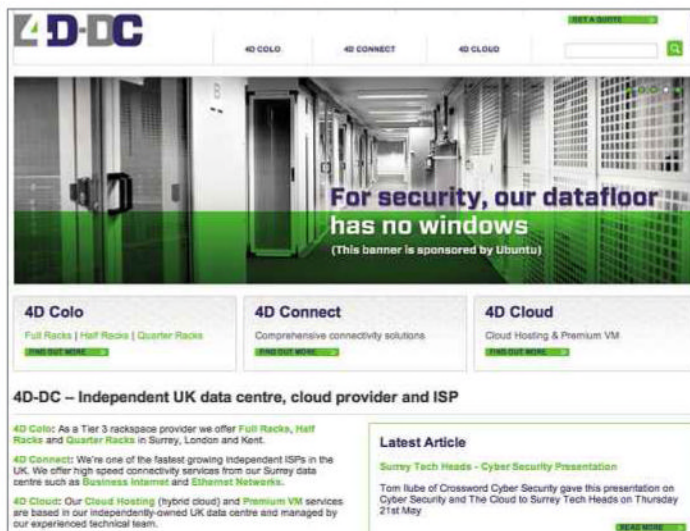
This might feel a million miles from modelling a new jet-engine design, but from the twinkle in the eyes of a few of the Cray engineers I gleaned that it actually might not be all that far – they’re all very firmly convinced that you can’t get real supercomputer performance from mix-and-match environments.

I rather suspect that these same concepts from graph theory underlie the design of proper supercomputers with tens of thousands of cores. To compute all that data and have the answers thrown back onto some lesser device for you to read, the secret sauce lies in the OS. It’s the OS that has to figure out a whole lot of dataflows, quite irrespective of what those dataflows represent. They could be Germans going on holiday; they could be meteorological readings from sensors in the North Atlantic; they could be obscure statistics about baseball players (one US baseball team uses a Cray that it consults in the short interval between a new pitcher being presented and a batter being chosen to respond – and no, I didn’t understand this either).

I suspect the gap in comprehension between Cray as an old-school supercomputer maker and these new plug-and-play evangelists boils down to a very unfashionable word indeed: maturity. Even though almost none of that original 1972 business remains, what has been carried over is far more than all the clever code libraries and approaches to computing, embedded in bits of hardware that don’t even get rated in the speed-comparison charts: it’s a far longer-term understanding of businesses, too, and of how they may try to use information technology, without some of the sacred cows and crazy constraints of the IT business as we’ve all come to know it in the early 21st century.

Of clouds and hosts

Oh boy, is Red Hat ever excited about its Cloud Suite for Applications. This is a platform that gets laggy, lazy developers up to delivery speed with whatever funky web widget they’re trying to put together, without having to necessarily kowtow to those equally laggy and lazy web hosts, who can’t see that the world has changed. Everyone is tearing up even those transformative cloud strategies,



which had already torn up the old guard of hosting. Yes I know, after you’ve listened to too many cloud industry presentations, the words kind of tumble into one another until you can’t identify what they think they’re saying, let alone what it might mean for you (the presenters have promoted themselves from merely “excited” – so 2009 – to “super-excited”). That’s why it was ideal timing to go straight from the Red Hat briefing over to a far calmer and more down-to-earth chat with David Barker, technical director at 4D-DC (4d-dc.com).

He has a new architecture for hosting, which is why we were chatting, but I was more interested in some counterpoint to the super-excitement of the Red Hat launch. We ended up talking about the way his existing customers had driven his interest in putting the dreaded “c” word into what had been a pretty straightforward hosting and rack-space business.

He was clear about this: while the leading-edge announcements are all very clever (and there’s no doubting that, in some distant lands, the high pace of change at work will lead us into a very different web-server world), from his perspective, his clients are much more interested in long-term stability. Where a cloud platform helps with that – for instance, through its ability to move a running VM from a host that develops problems onto one that’s working okay – they’re exceedingly interested. But go too far with the highfalutin, scalable, transportable, standards-driven, containerised OpenStack-ready blah, and those same customers will just stop listening.

ABOVE 4D-DC has a refreshingly grounded take on the cloud

“After you’ve listened to too many cloud presentations, the words kind of tumble into one another until you can’t identify what they think they’re saying, or what it means for you”

My relief at hearing this verged on the boundless, because that’s more or less what I’d been saying earlier that day to Lars Herrmann of Red Hat, while he was getting carried away and amazed by the possibilities presented by Cloud Suite for Applications. Unfortunately for my frazzled brain, he grabbed the down-to-earth point and ran with it.

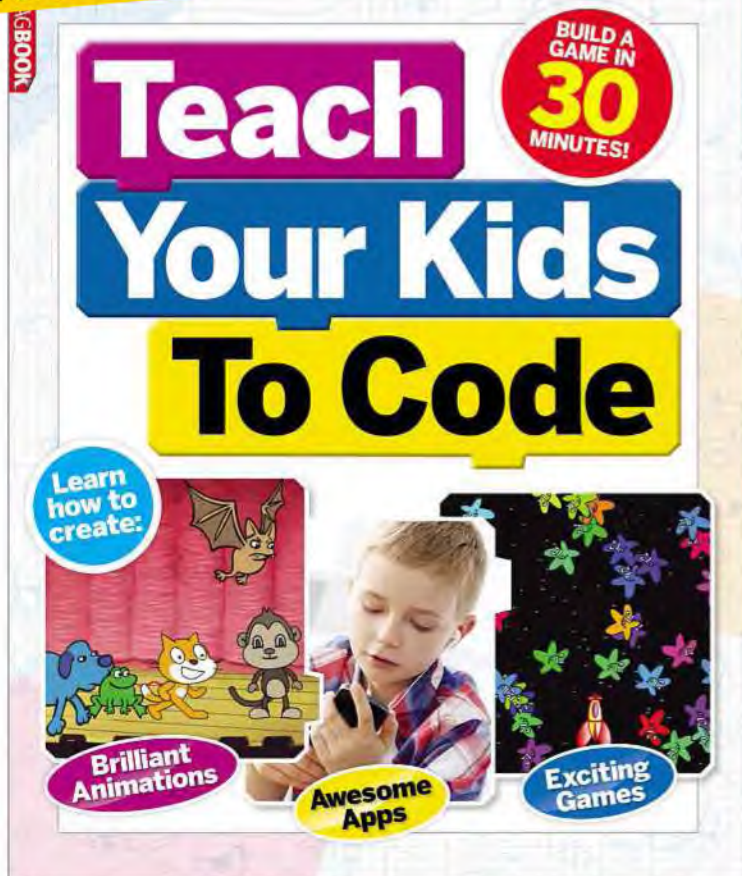
The whole proposition for Red Hat is that asking hassled developers – who have websites they need to bang out – to keep careful track of where the hosting business would like to

pigeonhole this or that resource (Is it IaaS? Is it PaaS? Who really cares?) just slows everything down. It makes it much harder for them to prepare their site designs for the brave new world of OpenStack, and that includes the database and the workflow an end user has to undertake, not merely the chunks of Java or CSS sheets or such like. This is where I think Red Hat needs to listen very carefully to people such as 4D-DC’s David Barker.

Not once in his positively overbrimming presentation did Lars mention cost, which is a classic omission for a Red Hatter, what with them being so open and all. Neither they nor the bigger beasts they’re targeting with this toolbox (AWS and Azure) like to make the pricing of the final, delivered web-commerce application easy to discern during the design or testing phase. The costs will rise as your traffic rises of course, but when your traffic does rise you’ll be making more money – so what do you care if the bill goes up, right?

David, as a long-term hosting specialist, knows very well that customers are going to care a great deal about the bill, and many of them don’t take kindly to being told they ought to be “more responsive to flexible demand” or some other rapid-fire, cloud-jargontastic nightmare. Customers are far more likely to choose trailing-edge, simple, predictable products and companies over the big players if they start to get the uneasy feeling that they’re being blinded by gobbledygook. This is a profound truth of the commercial market that both David and I seemed to understand, without having to get “super-excited” about anything.

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New!

Teach Your Kids to Code

Computer programming is now part of the standard school curriculum, so there's never been a better time to help kids develop their coding skills. This book will show you and your kids how to get started with the basics of programming, and then take that

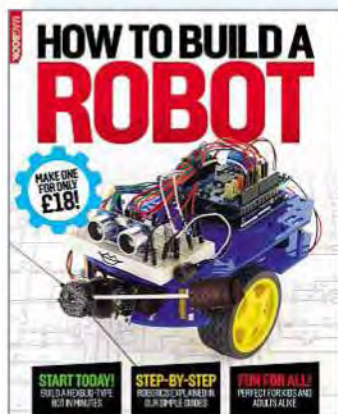
“Fun projects that will see you get to grips with programming fast!”

potential further. Read our guide, follow along with the projects and get to grips with the fundamentals of programming, and you and they can learn together.

The projects in this book are fun to create – and they're easy to customise too, so young coders can build on what we've put together to stretch their creativity and make their own mark.

But it now from Amazon
at pcpro.link/ppkidstocode

How to Build a Robot for £18

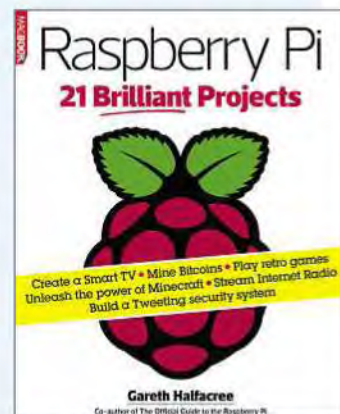


You don't need to be a technical expert to get involved in one of the most rewarding hobbies around. Using the Arduino platform, we start with a simple project, and gradually build up into a complete robot. You'll also find inspiration for advanced projects, and troubleshooting help should you need it.

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Raspberry Pi: 21 Brilliant Projects

Get the most from your Pi with these hands-on projects. Follow our step-by-step instructions, and before long you'll be a Pi pro! From an absolute beginner unpacking a Pi for the first time to a hacker jumping from rival platforms, you'll find something to get your teeth into, with plain English instructions at every step.



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Futures



We explore the trends and technologies that are set to shape the future

Print-outs ready to eat

The 3D-printer firm that's running off customised cookies **p126**

Technology to heat your home

Housing a Nerdalize server in your home will help in the winter **p127**

Geek Day Out

Visit the first 3D planetarium at Bristol's Science Centre **p128**



Lift-off for EasyJet's drone crew

The budget airline is trialling maintenance drones, 3D-printed replacement parts and much more. **Nicole Kobie** reveals why the company is looking to the future

A maintenance drone buzzes through the air, scanning every inch of the surface of the aircraft. On the ground, engineers viewing images from the drone discover the problem: the exact spot where lightning struck the plane, weakening the structure and forcing it to be grounded.

This is a scenario EasyJet is trialling, in an attempt to reduce groundings of aircraft from days to only hours. It's but one of a series of cutting-edge techniques the budget airline is testing to ensure its fleet remains in the air as much as possible.

■ Eyes in the sky

Lightning and bird strikes can ground a plane for days. Engineers must inspect the entire body of the aircraft,

going up in cherry pickers to enable them to examine the plane from every angle. Now, EasyJet wants drones to carry out the exploration, with engineers examining the video from the ground – cutting turnaround time to just hours.

"A lot of people have thought that the drone is doing the inspection," Mark Bunting, EasyJet's drone programme manager, told *PC Pro*. "But our first version of this is [for the drone] to provide video footage to an engineer. It's actually an engineer's aid."

The initial thought was to manually fly a drone around planes, but that would require staff and a lot of setup, and would be harder to do outside without infrastructure to aid the drone. Instead, EasyJet

worked with drone manufacturer Blue Bear and its Riser hardware, which is already used to carry out inspections of tall buildings and ships.

The Riser uses a pair of lasers, known as Lidar, for detection and ranging. Tell the Riser drone to stay several inches away from the plane, and it simply works its way around the surface from that distance. "The [drone] is able to fly safely around the aircraft and map all of it," said Bunting. "It's able to take a visual record of all of it."

Engineers appreciate the drone, because it spares them from having to clamber up and down in heavy machinery to examine planes. Plus, there's no concern over the drones making the engineers' jobs redundant. Bunting said the work still requires a human to judge the damage and assess what needs to be fixed. "There's no machine that can do that sort of job," he explained.

The next goal is to provide engineers with a better user interface. They aim to map the video onto a

ABOVE Drones will carry out an initial assessment of EasyJet's fleet

BELOW The Riser uses Lidar lasers to detect issues on the surface of aircraft



Software plane-spotters

It isn't only new hardware on which EasyJet has its sights; it's also looking to new fault-predicting software, virtual reality for training, and much more.

Working with aircraft maker Airbus, the firm is developing a "state-of-the-art, early-fault-prognosis tool" that will use in-flight telemetry to spot technical flaws before they become an issue. The software pulls in real-time data, mapping it on to an animated schematic that can be used to troubleshoot technical faults – even before the plane lands, according to an EasyJet technical document.

Planes aren't the only concern, with EasyJet working with virtual-reality firms Output42, Design Q and Mediasphere, to make training and maintenance tools for cabin crew. The airline is testing a 3D laser technology that scans plane interiors, producing a 360-degree digital model in which crew can train; they learn

their way around using an Oculus Rift headset. The firm is also using games with simulated customer-service scenarios to improve interactions with passengers, and developing a cabin-maintenance app to replace paper-tracking systems.



Virtual reality is being used to help train EasyJet staff



Of course, none of technologies mentioned will help you get through check-in queues any faster – but EasyJet has built an app for the Apple Watch with which to book and manage flights, too.



digital model of the plane, making it easier to locate the damage and automatically link to the relevant section of the manual, where material limits are documented. Currently, engineers still have to flip through documentation to look up such details.

The airline said it's planning to bring the drones into service at up to ten of its engineering bases, including Luton and Gatwick, by the end of 2016.

3D-printed planes

The interior of EasyJet's planes might soon be notable for something other than their orange decor, with plans to 3D-print window blinds, dropdown trays, armrests and other cabin furniture. Currently, spare seats and other replacement parts are stored in a warehouse, and shipped to airfields when needed, or they have to be manufactured on demand. "So the part is sitting on a shelf or it has a long lead time," said Bunting.

To counter such issues, EasyJet wants to set up a high-end 3D printer, at Luton or another airport, which could be used to print parts for all of the airlines that operate there. It may seem surprising that airlines would use a 3D printer to replace seat parts, but in-cabin items are a pain point in the industry, not least because every airline has different seat designs. "Seating manufacturers can't keep up with maintaining stock, because EasyJet comes along and wants a slightly different seat design," he said.

At the moment, the EasyJet trial is restricted to in-cabin items, but in the future the airline is hoping to use the printing technology for engine parts too. For that, it has to wait for the arrival of the LEAP (leading-edge aviation propulsion) engine, which features carbon-filter fan blades and a 3D-printed fuel nozzle. The latter was designed to be 3D-printed because it combined what was previously a multipart object into a single piece, simplifying assembly and reducing fuel consumption. "They can effectively make a nozzle to work perfectly," Bunting said.

"And that's where the future in manufacturing with 3D printing is – design-to-print, rather than printing an old design," he said. "They've designed a fuel nozzle for the printing method, instead of designing a nozzle and then printing it."



BELOW 3D printing could be used to replicate engine parts

It may be surprising to see such bleeding-edge innovation coming from an infamously cost-conscious airline, but EasyJet has a relatively modern fleet with which it's prepared to experiment. It currently has more than 200 planes, and is looking to add more than 100 new aircraft to its fleet. "We give people who are willing to

come up with cutting-edge ideas access to our planes, our expertise and operation," said Bunting.

The ideal outcome for EasyJet is discovering financial and time efficiencies – anything

that would "make a huge difference" to how the company operates. "But we don't actually do much of the work ourselves," he said. "We engage with the people who are going to make money out of it. We have no interest in the intellectual property, nor in owning the product."

Instead, people such as Bunting work with tech suppliers to develop ideas and trial them. And it's a win-win situation. If the idea works for EasyJet, it's saving the airline money while, because of the size of its fleet, the supplier has a large market to instantly sell into. "And because of the size of our Airbus fleet, there's a knock-on [effect] into the aviation community, as everybody else benefits from it as well," Bunting said.

In other words, expect drones and 3D-printed armrests to take off for other airlines, too. ●



A taste of 3D: food printers heading for coffee shops

3D printers may be adept at knocking out plastic toys and components, but what if they could rustle up grub? Well, thanks to XYZprinting, that's soon to become a reality. We spoke to CEO Simon Shen to find out more

3D PRINTING HAS been used to build apartment blocks and create body parts – and now it's being used to construct lunch. XYZprinting's food printer was on show at January's CES, and it's set to arrive in the UK this year, enabling coffee shops to offer bespoke cookies and the rest of us to create a meal via tubes of ingredients that are sprayed onto the plate. We spoke to CEO Simon Shen to find out if this is a tasty idea or a weirdly complicated way to make a pizza.

■ **XYZprinting isn't new to printers. How did you come to develop a printer for food?**

"We started in paper printers, meaning inkjet and laser printers, and we've been doing that for 15 years," said Shen. "We still produce 15 million printers per year." Two years ago, the company asked customers if they'd be interested in a 3D model. "They told me the 3D-printer market is very small, it's too early, they may not be interested at this point in time," he said. "However, we decided we may not be able to wait until the market matures. We need to spend our resources and develop 3D printers."

That led to the da Vinci line of consumer 3D printers, which picked up awards at CES, and the Jr edition, which arrived in the UK at only £299 (see p77).

■ **How does a 3D food printer work?**

One machine can print a variety of foods. As with existing 3D printers, it feeds the material through a nozzle, using different tubes of ingredients to make up the recipe. "You just pick up a tube from the refrigerator and you print with it," said Shen. "Then, it has to be baked afterwards." Imagine the



3D print jobs you do now, but with cookie dough instead of plastic, and you get the picture.

■ **From an engineering standpoint, what's the difference between printing in plastic and printing with edible ingredients?**

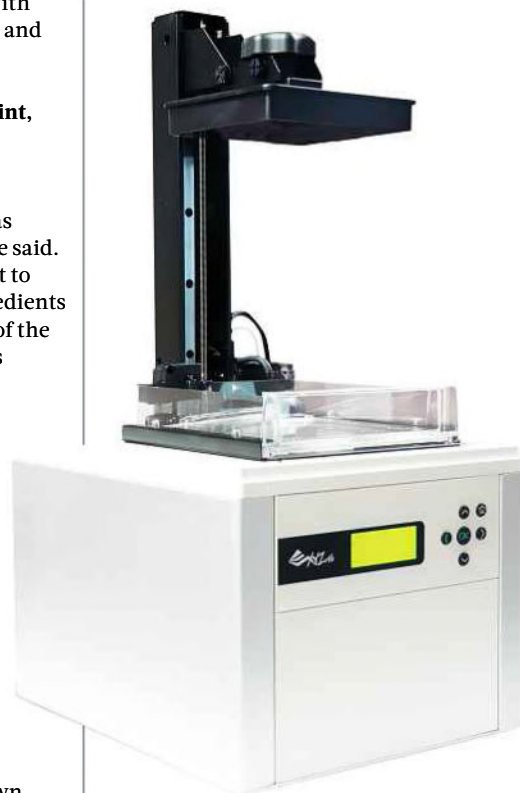
"The hardware design was not as difficult for us ... as the food," he said. The company hired a consultant to experiment with different ingredients and the "so-called compounds of the food". So far, the consultant has created recipes for cookies, chocolates, cupcakes, pizzas and macaroons.

■ **Who would buy a 3D food printer?**

Shen is already in talks with food retailers in Taiwan and Japan. "The idea they have is to put a 3D printer in hotels or coffee shops. For example, if you go into a coffee shop [with a food printer], you can have cookies made instantaneously with ... your own design, your name, the Hello Kitty sign, whatever," he said.

ABOVE The da Vinci Jr, available in the UK for only £299

RIGHT The Nobel 1 uses SLA technology to print more quickly



It's not only for novelty desserts. A Taiwanese convenience store is looking to use the machine to offer a wider range of products. "All the [food] right now in the convenience store is prepackaged," he said. "But with 3D they can just print it."

■ **Will this eventually end up in people's homes?**

"I think every home will have one, just like every home has a coffee maker," Shen said, adding that the printer will hopefully come to the UK this year. "Three years, five years, ten years down the road, if the price point drops to a certain level ... every home will eventually have one."

"In Japan, they are able to print bread. You can actually print that at home instead of buying it from the store," he added.

But the future may be odder still. "Some companies are trying to use our 3D printer to print meat ... and eggs," he said. Vegetarians may rejoice, but we'll reserve judgement until we've had a taste. ●



What is... a data furnace?

Put the heat generated by a computer to good use: data furnace firm Nerdalize is offering free heating in exchange for running a server from your home



Data centres create huge amounts of heat, and keeping them cool can be a challenge, not to mention expensive and damaging to the environment. Research suggests that as much as 1.5% of electricity use around the world is devoted to powering and cooling data centres.

Rather than let that heat go to waste, some data centres are using it to warm other buildings – Swedish firm Bahnhof pumps it into Stockholm's municipal heating system, for example. Data furnaces take the concept further, placing the servers in people's homes, where the heat they generate is used for domestic heating. The first firm offering the service is Nerdalize, based in the Netherlands. Here's how it works.

Nerdalize turns your home into a server farm? Cosy. Not quite. Instead, it attaches a radiator-style box to an external wall in your home. Inside that lives the server equipment, which connects over your fibre internet connection to provide distributed cloud computing services to Nerdalize's customers. It's slightly larger than a standard radiator, and pumps out 1kW a day – about half the output of a standard radiator.

What about in the summer? Or if the internet goes down? Nerdalize's server radiators can be switched off, with the excess heat funnelled outside – which is why they must be installed on an external wall. And if your internet connection goes down in the winter, you won't freeze: the server has dummy equations to run if it has

nothing better to do, so your home will be kept toasty.

Won't this just rack up my electricity bill? Nerdalize will pay for the electricity it uses. There is a €400 (£283) setup fee, and the startup won't pay for your internet connection.

How does Nerdalize earn from this? It sells access to the servers to firms and universities. The startup claims the cost of its service is 55% cheaper than rivals, because it doesn't have the overheads created by data centres. However, because the servers aren't all in one place, the service isn't ideal for all, particularly those who require fast processing. Nerdalize says its grid computing is used for video transcoding, engineering models, and scientific computing – anything that benefits from parallel computing, but doesn't need to be done in a hurry.

What if the homeowner fiddles with the server? It's secured, but if you tamper with it, Nerdalize can wipe the server so that you can't access the data. Plus, all data is encrypted. The creators argue that the distributed system is more secure than a centralised data centre, since it would be tough for hackers to locate all the points to target a specific company.

Free heating, environmental benefits, plus geek credentials? Sign me up! Only if you're Dutch; Nerdalize is only available in the Netherlands, and there's no word yet on whether it will come to the UK. Give the startup a nudge by signing up for updates at nerdalize.com.

Crowdfund this!

Our pick of UK tech projects on Kickstarter and Indiegogo

Chatrbell smart doorbell

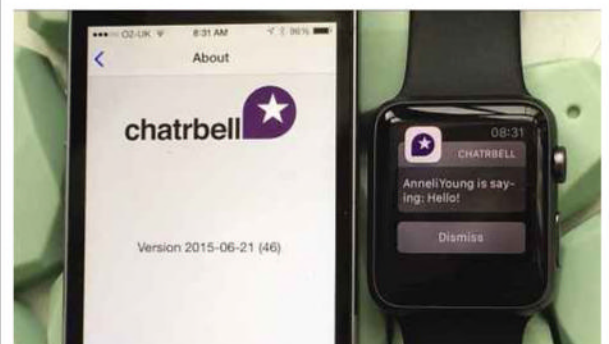


What is it? Chatrbell is an update to your existing front doorbell, which is a rather analogue idea: when else would you ring a bell to get someone's attention? This isn't the Victorian era, when we had butlers to attend to such interruptions. Instead, Chatrbell sends a notification to your phone, after which you can either get up and open the door, ask visitors to identify themselves via the built-in chat service, or ask them to send a photo for identification.

So you still have to get up and answer the door? Yes, it simply lets you ask who's there, but this means you won't miss a visit if you're in the back garden, or can make arrangements if you're away from home. For example, you can send a courier a message to direct them where to leave your package.

How does it work? The Chatrbell "Flare" is a small device you stick on the inside of your door that sends your home ID signal out to visitors' apps. The signal is sent over Bluetooth via the iBeacon system on iPhones; Android isn't yet supported.

Wait, so visitors need the app too? Yes, and that's one obvious downside to this project: both parties need to have the Chatrbell app installed, which seems rather optimistic. It would be simpler to tape a note on your door asking visitors to call your phone when they arrive – it's hard to imagine that couriers infamous for failing even to ring doorbells to speed "deliveries" will take the time to install an app when faced with your doorbell-less home and a Chatrbell sticker in the window.



That sounds like a downgrade to the system, not an improvement. Chatrbell's London-based creator Andy Young says doorbell notifications are only the beginning. Features he expects to see in the future include remote door-lock controls, integration with existing entry intercom systems, built-in camera systems, and e-signatures for deliveries.

How much will this doorbell revolution cost? For £15, you receive your very own Chatrbell Flare. At the time of writing, the project had raised only £987 of the £85,000 target, with a deadline of 27 July.

Link: pcpro.link/251chatrbell

Geek Day Out: At-Bristol Science Centre

See the universe in 4K at the At-Bristol Science Centre's new 3D planetarium – before spacing out on 300 other exhibits



Dual 4K projectors powered by 16 PCs offer a 1.6 billion-pixel, 3D view of the universe at the At-Bristol Science Centre's new planetarium.

"Using this system you can have an astronaut's eye view of Earth, peer inside a glowing nebula, and even fly through the rings of Saturn," said PR manager Jen Forster.

Once you're done exploring space in 3D, there are 300 other exhibits to gawp at. Highlights include Eye Witness, which showcases the software the police use to "evolve" faces using facial recognition; Space Walk, which makes good use of a Kinect hack; and the Surprising Sounds listening game, which is a firm favourite of visitors. "In a day, visitors can walk through a tornado, test the speed of their reactions, build a house, pull a bubble over their whole body,

“In a day, visitors can walk through a tornado, build a house, and even take a trip to the stars in the Planetarium”



ABOVE Visit the UK's first 3D planetarium, and have fun with bubbles too (left)

talk to a robot waiter, take a trip to the stars in the Planetarium, freeze their shadow and more," Forster said.

The centre is designed for all ages – the planetarium even goes 2D for younger visitors – and features Toddler Takeover days for little tykes and after-hours events for adults. The next adult-only event is 8 October, and if you're making plans for next year already then summer 2016 will see a "Make It" exhibition focusing on the maker movement, with robotics and coding playing a central part.

The At-Bristol Science Centre is open daily. Tickets cost £12.60 for adults and £8.10 for children. To save cash, try a late-entry ticket: arrive 90 minutes before closing for half-price entry. The planetarium is an additional £3. For more details, visit: at-bristol.org.uk.

Coming up Wood chips

As the mountain of discarded silicon goods grows ever higher, US scientists have invented what could be the first biodegradable processors

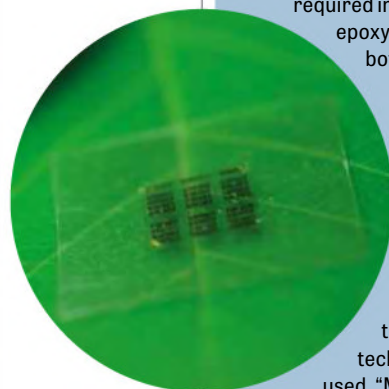
We're churning through new gadgets faster than ever, plunging even more toxic materials into landfill. But researchers in Wisconsin may have a solution: processors made mostly from wood.

The chips still use standard semiconductor materials for the key parts – you wouldn't get a great clock speed out of timber transistors. Yet as Zhenqiang Ma, a computer engineering professor at the University of Wisconsin, pointed out, the majority of material in a chip is simply there for support. "We use less than a couple of micrometers for everything else," he said.

Rather than use relying on toxic ingredients such as gallium arsenide, Ma has built those support layers with a wood-based biodegradable material called cellulose nanofibril (CNF). "Now the chips are so safe you can put them in the forest and fungus will degrade it. They become as safe as fertiliser."

Using wood or paper in the production of electronics raises concerns that the chips will expand when heated, or lack the smoothness required in processors. An epoxy coating solves both challenges.

The researchers claim they've assembled CNF chips with "performance comparable to existing chips", but admit it may be some time before the technology is widely used. "Mass-producing current semiconductor chips is so cheap, and it may take time for the industry to adapt to our design," Ma said. "But ... we think we're going to be well ahead of the curve."



ABOVE Made from wood, these chips are environmentally friendly

Coding challenge

Deciphering ambiguous Morse code messages

The Victorian internet

The first Morse code message was sent in 1844, which is why Morse code sent over the telegraph is sometimes called “the Victorian internet” – it was the first system that allowed global communication. By tapping out dots and dashes, an operator could send messages at up to 35 words per minute – faster than most modern teenagers can send messages from their mobile phones.

.. A B	... C	... D	. E
.... F	... G	... H	.. I	... J
... K L	.. M	.. N	... O
.... P	... Q	... R	... S	- T
... U	... V	... W	... X	... Y
... Z				

The sequence of dots and dashes is sent with a short pause between each letter, allowing the listener to tell where letters start and end. Without the pause, this wouldn't be possible and the message would be ambiguous. For example, the sequence for CAT would be “-... - - -”, but with the spaces taken out it would be “-...-”. There are many different ways of interpreting this depending on where you put the spaces:

... - -	- - -
C A T	T E X T	K I M

Can we use a computer program to decode a word written in Morse code without spaces? In a word, yes. One way to do this is by using a brute-force attack. Morse code letters never have more than four dots or dashes, so we know that an incoming message must be broken into chunks of one, two, three or four characters.

Since our sample code has seven characters, we could break it into seven one-character chunks. Alternatively, we could divide the code into three two-character chunks with one character left over. These could be arranged in a number of ways, giving us four permutations to test:

2 2 2 1	2 2 1 2	2 1 2 2	1 2 2 2
... - -	... - -	... - -	... - -

To help generate these possible chunks of code, we could use a string of digits to describe the size of the chunks. For this example, a possible solution will be formed from up to seven single-character chunks, up to three two-character chunks, up to two three-character chunks and up to one chunk of four characters. If we make a string out of all these possibilities, “111111222334”, we can create an iteration function (or use an existing one, such as the one found in Python's itertools library) to generate all the possible permutations of different-sized chunks.

Many of these permutations will be invalid, of course. We can ignore chunking sequences that don't add up to the total length



of the original Morse message, so (1,1,2) and (3,3,4) can be ignored. We can store the valid chunk patterns in an array, meaning we can easily work our way through them later. You should end up with 56 valid chunk patterns, from (1,1,1,1,1,1,1) to (4,3).

The next step is to check each of these possible chunking sequences to see if the chunks described convert to letters of the Morse alphabet. An easy way to do this is to use a dictionary data structure, in which each unique Morse code chunk points to a capital letter of the alphabet. If it doesn't map to any letter, the whole sequence can be ignored. Otherwise, we can build up and output a translation – from “TETEETT” (1,1,1,1,1,1,1) to “CW” (4,3).

An incoming Morse code message must be broken into chunks of one, two, three or four characters

You could also cross-check the translated string against a dictionary file and output only real English words. Be warned, though: as you work with longer phrases, the number of possible translations increases exponentially, meaning

that your processor might take a long time to crunch through all the possible codes.

The challenge

The following Morse code words have had their spaces taken out. Can you write a program to translate them into words that make a phrase?

... - - -
... - - -

Once you've solved the challenge for the words individually, can you find a solution where the characters are combined into a single word with no spaces? **DAVID HUNT**



Westminster woes: Jon Honeyball offers some harsh advice to a prospective Labour leader

I'm not a political animal at heart. I can see much of benefit in what most parties have to say, and the rest makes little or no sense to me at all. I have no time for the political process either, noting just how few pre-election promises seem to make it through to reality. And I've nothing but loathing for those who do their best to climb the greasy pole, and to ensure their snouts are dug deep into the communal trough.

There are, of course, the rare exceptions – politicians who appear to have some element of moral fibre, of real public work ethic, and who bring experience of the wider world to the job. But I fear they're few and far between.

So when I point the finger of ridicule at a particular politician, don't make the mistake of believing I'm making a party political statement. I'm not. In my view, all MPs should stay in their constituencies, video-conference everything, and vote securely online. It would save a fortune on expenses, allow MPs to spend more time with their constituents, and make lobbying so expensive that no-one could afford to do it. All of which sounds like good democracy to me. However, we all know that the Civil Service and the whips simply couldn't allow power to slip from their fingers in such a way. I refer you to the great analyses of parliament written by Messrs Jay and Lynn for further education.

Now it's easy to take something said out of context. But I just want to lay this paragraph here for your consideration, taken from an interview with Yvette Cooper in *The Guardian* on 23 May:

"In her own Yorkshire constituency, where closure of the Ferrybridge power station was announced last week, she wants the children of the skilled workers who had jobs there for generations to be able to train for hi-tech leadership positions. 'The sons and daughters of miners should all be learning coding. We have such huge advantages because of the world wide web being invented as a result of British ingenuity,' she says. 'We also have the English language, but what are we doing as a country to make sure we are at the heart of the next technology revolution?'"

Be in no doubt, the closure of a large infrastructure item such as a power station is a terrible thing, and has effects that reach out

right across the local population. But what is her answer to this? The sons and daughters should be able to train for hi-tech leadership positions. Not just any old tech jobs, but "leadership" positions. They should be learning coding. And, to cap it all, we possess a huge advantage because the web was invented by British ingenuity.

Let's leave aside that Web 1.0 was a slim, feeble thing designed for a very specific task; and that the current web bears little meaningful resemblance to it. Let's leave aside that it was invented by someone who was working in Switzerland at CERN, using a computer from California. No, according to Ms Cooper, these daughters and sons of miners should be learning coding to get hi-tech leadership positions because of this heritage. And that English will and should be at the heart of the next technology revolution. Note: English, not American.

You might think these are the deranged ramblings of an idiot. I wouldn't disagree, although I suspect it's somewhat more likely that she's just being staggeringly ill-advised. In which case, Ms Cooper,

my contact details are at the bottom of the page, and my rates are reassuringly large.

I will gloss over the fact that, according to Wikipedia, she has never had a real job in her life, skipping from university to being an economic-policy researcher for John Smith in 1990, then to a bunch of other similar positions until sliding gracefully into the safe seat of Pontefract and Castleford in the 1997 general election. She has never, I presume, had to

run a business, small or large. Or do a quarterly VAT return. Or worry about meeting the payroll. Or work her way up from being the daughter of a miner, or laid-off power-station worker, to train for a hi-tech leadership position. No, none of that.

Here's an idea. Why don't we get all those coders to write this new system that allows MPs to work from their constituency offices. The public purse could fund all these hi-tech leaders who could then excel in this era of technical innovation – and, best of all, they wouldn't have to be housed in expensive offices in Hoxton (such a short, photo-op-friendly hop from Westminster, don't you think?).

So Ms Cooper, there's your remit as prospective leader of the Labour party. Let's see you do something meaningful, and help those people up there. And do it without sounding like a horrifyingly out-of-touch, London-centric MP.

“You might think these are the ramblings of an idiot; I suspect she’s just being staggeringly ill-advised”

■ Jon Honeyball is a contributing editor to *PC Pro* and MD of an IT consultancy. In the event Yvette Cooper does want to get in touch, email jon@jonhoneyball.com



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